

MACHINERY

AUGUST 16, 1961

ONE SHILLING & THREEPENCE

DETROIT PUBLIC LIBRARY

SEP 1961
TECHNOLOGY
DEPARTMENT



of course - we use no other!

ECLIPSE
14" x 1" x .050"
HIGH SPEED STEEL

10
TEETH

Made by James Neill & Co. (Sheffield) Ltd., and obtainable from all tool distributors



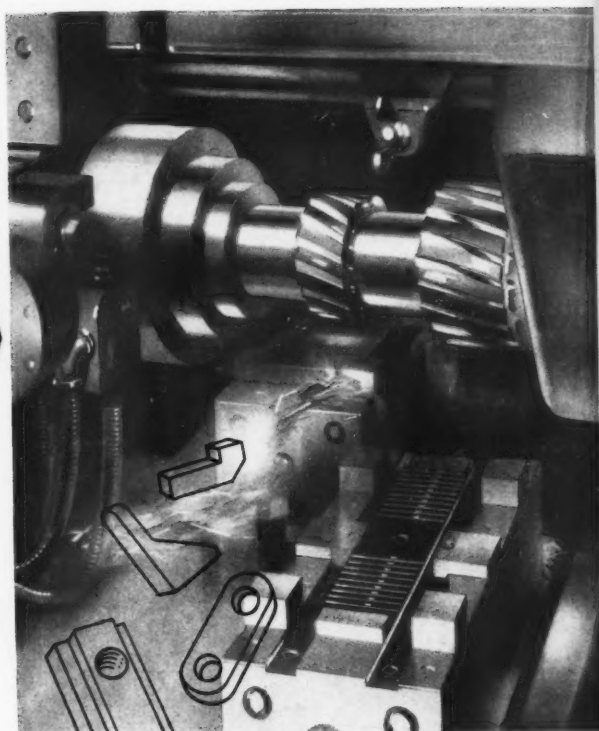
WOODRUFF KEYS



HEADED KEYS



PLAIN KEYS



MILLS *PRECISION MACHINED PARTS*



MILLS KEYS are used in all branches of the engineering industry.

The high quality of their workmanship and the low prices have created such a heavy demand that standard types in carbon steels are now always in stock. Special materials, finishes, machining features or heat treatment can be supplied at short notice and there is a large capacity for "specials" to customers own drawings.

Our technical services are available to advise you on the physical properties, design and any other problem connected with Keys or similar components.

EXORS OF JAMES MILLS LTD

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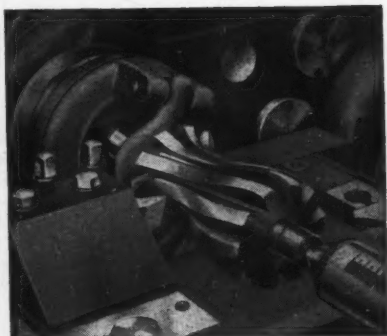
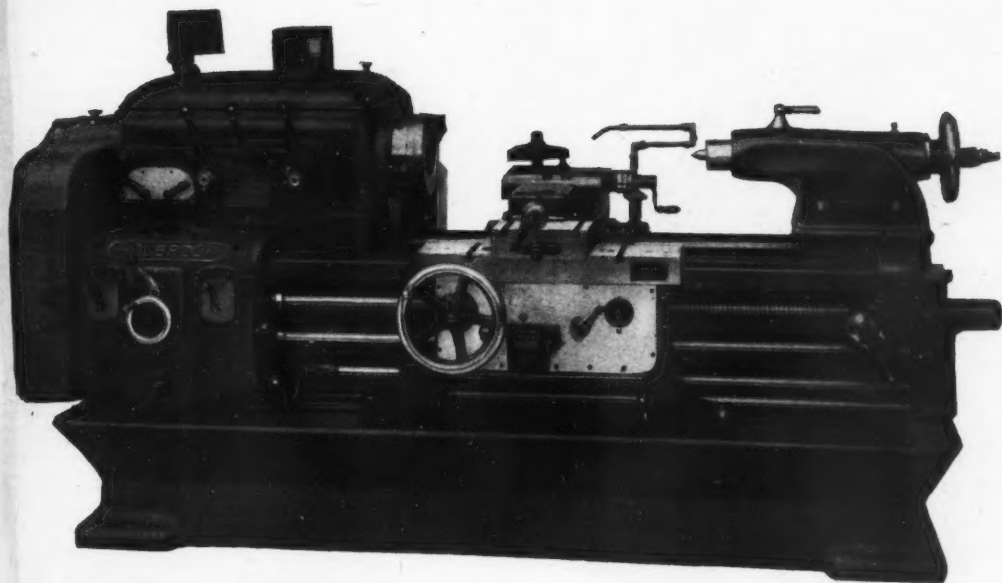
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MODEL 'R'

UNIVERSAL RELIEVING LATHES



BUILT IN TWO SIZES, FOR RELIEVING AND
GRINDING CUTTERS UP TO 4" AND 9" DIAMETER

FEATURES INCLUDE

PRECISION LEADSCREW WITH
COMPENSATING END THRUST

VARIABLE RISE CAM

3 TO 1, QUICK RETURN OF CARRIAGE
IN EITHER DIRECTION

REAR OPERATION, FOR LEFT HAND WORK

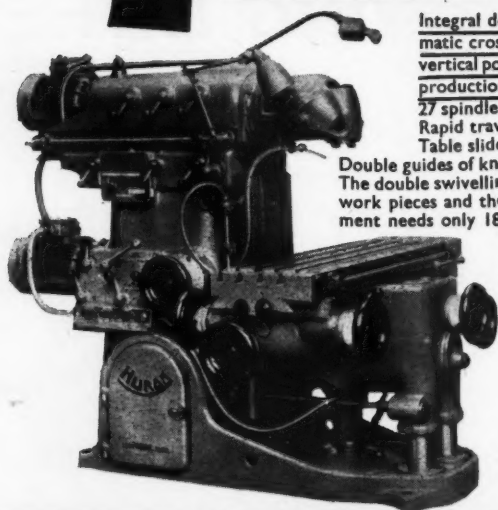
HOLBROOK

MACHINE TOOL CO. LTD.

CAMBRIDGE ROAD, HARLOW, ESSEX

When answering advertisements kindly mention MACHINERY.

SLIDING RAM
GIVES 27½ in.
AUTO CROSS
FEED



HEAVY DUTY MILLING

ANGULAR COMPOUND HORIZONTAL VERTICAL

HURON SUPER UNIVERSAL MILLERS

Integral double swivelling universal head provided with 27½ in. automatic cross feed by the sliding ram, can be set to the horizontal or vertical position, or to any angle instantaneously—permits the heaviest production cuts. Heads can be retracted completely from table line. 27 spindle speeds from 30 to 2,066 r.p.m., 27 feeds from ⅛ in. to 30 in. Rapid traverses in all directions. All operating controls duplicated. Table slides directly in the knee without cross movement or swivel.

Double guides of knee permit components in excess of 1½ tons to be machined. The double swivelling universal head requires an opening of only 14 in. to enter work pieces and the whole sliding ram with its 27½ in. automatic cross movement needs only 18 in. clearance. **OPTIONAL EXTRA FEATURES:** Mounted spacing casting assemblies providing additional 8 in. capacity under spindle. 26 in. wide 8 T-slot tables and 39 in. automatic cross feed of sliding ram with special heavy duty knee and front operating position.

Type	Table	Automatic Feeds		
		Long	Cross	Vert.
KU4	56½ in. × 15½ in.	43½ in.	27 in.	19 in.
KU5	64½ in. × 15½ in.	51 in.	27 in.	19 in.
KU6	78 in. × 16 in.	59 in.	27 in.	19 in.
KU55	64½ in. × 26 in.	51 in.	38 in.	18½ in.
LB3	157 in. × 59 in.	118 in.	39 in.	59 in.

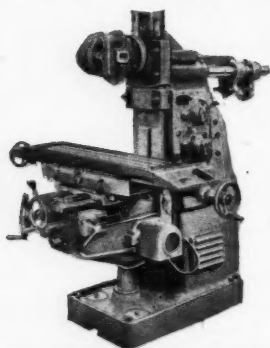
Type 'L' Open-side Traversing Head Universal Miller will mill, bore, slot and drill the largest work-pieces at one setting. The unique design permits greatest variety of operation on large work-pieces; the component remains stationary on the large work-table. Upright slide full length of base table and the sliding ram moves vertically and horizontally.

DUFOUR

UNIVERSAL
MILLERS

WITH DOUBLE UNIVERSAL SWIVELLING
HEAD, RETRACTABLE SLIDE BRACKET AND
SPACING CASTING GIVING 26" DAYLIGHT
ON No. 59 AND 21" ON No. 61

FOR ALL MODELS Direct reading dial change for speeds and feeds. All parts subject to wear hardened and ground and completely interchangeable. Built to closest tolerances. Rapid traverses in all directions. Table swivels 30°. No. 40 taper for main horizontal spindle, double swivelling universal head, dividing head and rotary table. Hardened and ground centre guide for slideways. Twin overarms. Double swivelling sliding spindle heads with speeds 53-3000 r.p.m. Double swivelling universal head on retractable slide bracket providing with 5½ in. Spacing Casting Drive assembly on 59 Machine 26 in. daylight, and 21 in. on No. 61.



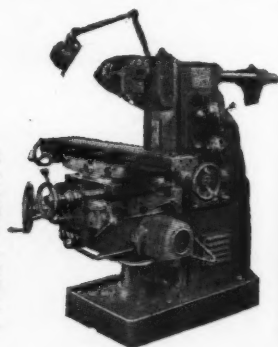
MODELS 53 & 61. 16 universal head spindle speeds.

21-1600 r.p.m.; 8 horizontal spindle speeds 21-1180 r.p.m.; 8 automatic feeds ⅛-18 in.

MODEL 59. 36 universal head spindle speeds 14-1780 r.p.m.; 12 horizontal spindle speeds 27-1180 r.p.m.; 16 automatic feeds ⅛-20 in.

MODEL 54. Automatic cross feed of universal head 20 in.; 18 universal head spindle speeds 12-1500 r.p.m.; 36 horizontal spindle speeds 6-1500 r.p.m.; 18 automatic feeds ⅛-23 in.

Type	Table	Automatic Feeds		
		Long.	Cross	Vert.
53	43½ in. × 9 in.	27 in.	9 in.	15 in.
61	47 in. × 10 in.	30 in.	9 in.	15 in.
59	51½ in. × 11 in.	34 in.	11 in.	21 in.
54	67 in. × 14 in.	43 in.	14 in.	20 in.



EUROPEAN MACHINE TOOL EXHIBITION, BRUSSELS SEPTEMBER 3-12, 1961

We look forward to demonstrating these machines to you on
STAND 9119, Hall 9; and STAND 6119, Hall 6

Send for full particulars of our very extensive range of these machines; ask for demonstration

Rudolph Carne & Co. Ltd.

SWAN WORKS, FISHERS LANE,
CHISWICK, LONDON, W.4.

Tel. CHISWICK 0514, 6585 & 0337. Inland Telegrams: RUDCAR, CHISK, LONDON. Overseas Telegrams: RUDCAR, LONDON, W.4

announcing the

MOORE

NO. 1 1/2 JIG BORER

ALL THE FEATURES OF THE No. 1...

Plus

- 10 1/2" x 19 1/2" Table Surface
- 2 Feeds instead of one
- Variable Spindle Speed
- No Gibs, No Overhang,

... AT A POPULAR PRICE!

This is the logical successor to the renowned Model 1, a robust precision tool engineered for long life accuracy.

Check tolerances — and price!

check these figures...

LONGITUDINAL TRAVEL:

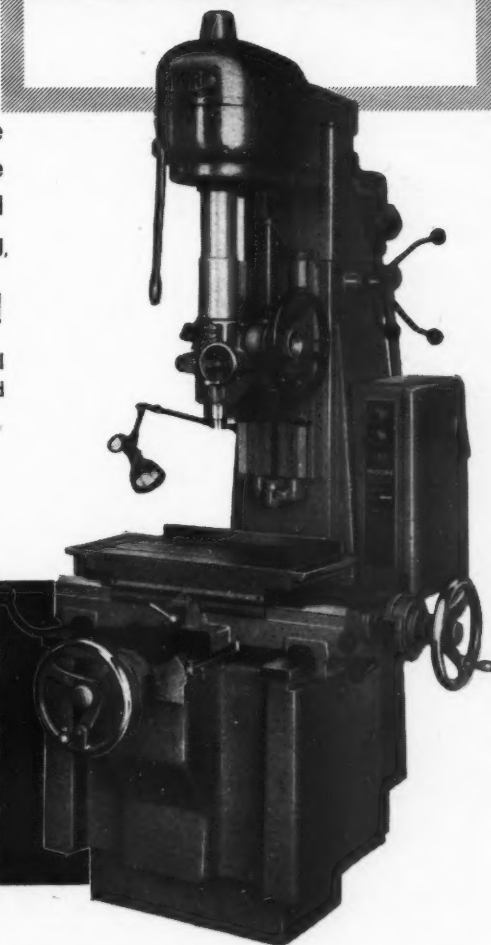
Greatest error in any inch	30 millionths
Greatest error in 14 inches	90 millionths

CROSS TRAVEL:

Greatest error in any inch	30 millionths
Greatest error in 9 inches	90 millionths

SQUARENESS:

Compound slide (full travel)	75 millionths
Travel, spindle housing	90 millionths in 9
Travel, spindle	90 millionths in 3 1/4



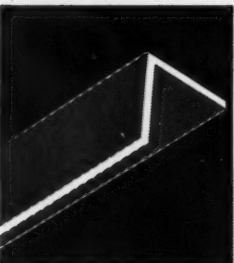
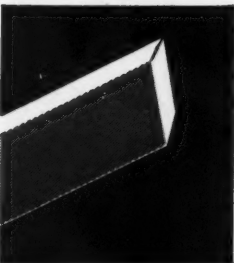
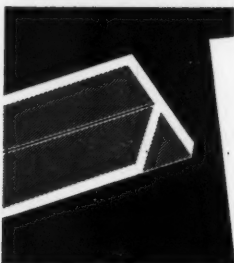
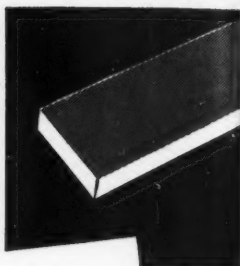
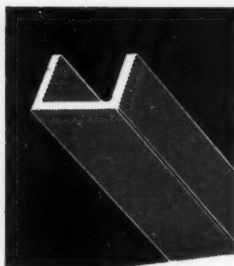
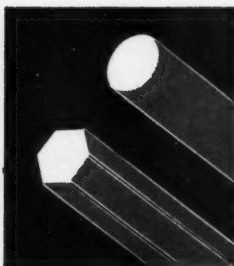
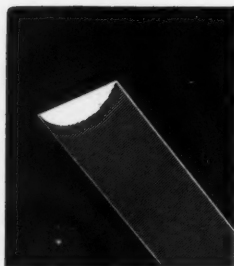
** and for checking —*

The **MOORE** UNIVERSAL MEASURING MACHINE

CATMUR

MACHINE TOOL CORPORATION LIMITED

103 Lancaster Road, Ladbroke Grove, London, W.11. Phone PARK 9451/2



Your metal requirements
CAN BE SATISFIED BY
NETTLEFOLD & MOSER
WIDE RANGE
WITH A SPEEDY DELIVERY SERVICE

Our Stock range covers:
 'Mills' Bright Steel: rounds, squares, hexagons, angles, flats.
 'Mills' Ledloy Bright Freecutting to Spec. EN.I.A:
 rounds, squares, hexagons:
 'Mills' Bright Super Non-Leaded Freecutting to Spec. EN.I.A:
 rounds, hexagons.
 'Mills' Bright Steel to EN Specifications.
 Aluminium Sheets.
 Brass Bars & Flats.
 Black Mild Steel: rounds, squares, flats, angles, channels, tees.
 Steel Plates.
 Sheets: Black: Cold Reduced General
 Purpose and Oiled, Hot Rolled Strip
 Mill, C.R.C.A.P.F.
 Galvanised: "Galvatite", "Speltafast",
 C.R.C.A.P.F., Corrugated.

Nettlefold & Moser Limited are
 main stockholding agents for
 Exors of James Mills Limited
 (Bright Steels) and United Non-
 Ferrous Metals Co. Limited
 (Brass Bars & Flats).

You save time by ringing

Nettlefold & Moser



the metal stockholders—FIRST

NETTLEFOLD & MOSER LIMITED LONDON (Head Office)
 170-194 Borough High Street, S.E.1. Tel: HOP 7111 (40 lines) **BOOTLE**—Dunnings
 Bridge Road, Bootle 10, Lancs. Tel: AINTREE 4171 (6 lines) **HULL**—201 Sculcoates Lane. Tel: HULL 41341 (3 lines)
 NM49

When answering advertisements kindly mention **MACHINERY**.

Special Vertical Milling Machine CVM60

Table (working surface) 108 in. x 30½ in.
Spindle Nose to Table, max. 41 in.
Spindle Driving Motor, 40 h.p.

Spindle Speeds up to 1000 rpm
Table Feeds up to 48 ipm
Spindle Sleeve Feeds up to 24 ipm

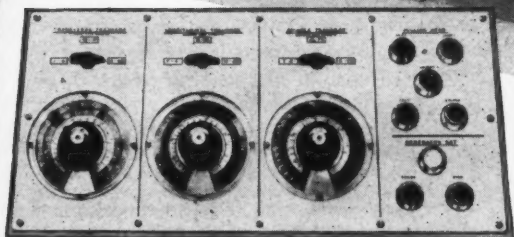
*Infinitely variable
Table Feeds*

*Infinitely variable
Spindle Feeds*

*Electric Locking
to Spindle Sleeve*

*Electric Locking
to Milling Head*

*Backlash-free
Table Drive*



KENDALL & GENT

GORTON MANCHESTER

Phone EAST 3282



SPECIALISTS IN PLANO-MILLERS and VERTICAL MILLERS

Brussels Exhibition—Kendall & Gent Plano-Milling and Face-Milling Cutter Grinding machines will be shown on Stand 5207 at the 7th European Machine Tool Exhibition, Sept. 3-12 1961

K259

"What is it that you like most about

REISHAUER?"



"Two things—remarkably high production and simplicity of setting and control."

"Do you get burning of the tooth-flank on the REISHAUER?"

"We did at first but found it was entirely our own fault through using the wrong types of grinding wheel."

"You grind on batch production but what happens if you have to grind a highly accurate gear?"

"No trouble on the REISHAUER—as a matter of fact we've ground master gears on the machine."

"You are gear grinding specialists and have added a REISHAUER ZA to a shop already filled with gear grinders. What then would be your advice to a firm who have not a single gear grinder and are wondering which would be the best choice to make?"

"You just couldn't better the REISHAUER. It is so universal and look at the high helix angle (45°) it will accommodate!"

"I understand that tip and root relief are obtainable on the REISHAUER. Is it very complicated to arrange?"

"On the contrary—the required amount is put on the cam or template in the dressing device and it stays put until the job's done."

"When you get the combination of coarsest D.P. and greatest helix angle do you get trouble with the grinding wheel producing the correct result?"

"We have in fact had this trouble but it was remedied by employing a compensated wheel form."

7th European Machine Tool
Exhibition—BRUSSELS
STAND 5032
HALL 5

**SWISS
REISHAUER
GEAR GRINDERS**
FOR SPUR & HELICAL GEARS
NZA for gears 4" to 11½" diameter, 5 DP.
ZB for gears up to 27½" diameter, 3½ DP.



DOWDING & DOLL LTD

346 KENSINGTON HIGH STREET, LONDON, W.14

Tel: WESTERN 9877 (8 lines) Telex: 33182 Gears: ACCURATOOL LONDON TELEX



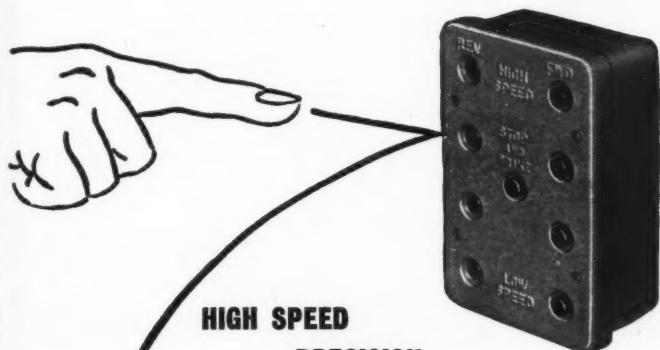
Record of an actual conversation between
a Reishauer user and a prospective
purchaser.

Write for illustrated brochure M/161 today

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When answering advertisements kindly mention **MACHINERY**.

***NOW-* Finger-Tip Control for Seated Operation**



**HIGH SPEED
PRECISION
ACCURATOOL CAPSTAN
5/8" or 13/16" bar capacity
and
SECOND OPERATION
LATHES**

With the controls at her finger-tips the operator performs the simple necessary motions much more rapidly, saving time on each component. Seated comfortably, she experiences little or no fatigue. Resting time is reduced and the flow of work is more constant and rapid. The basic machine can be used either for bar or second operation work and from the extensive equipment available can be selected just the right items for your needs.



Ask for
illustrated
catalogue
M/166 from

Sole World
Distributors



DOWDING & DOLL LTD

346 KENSINGTON HIGH STREET, LONDON, W.14

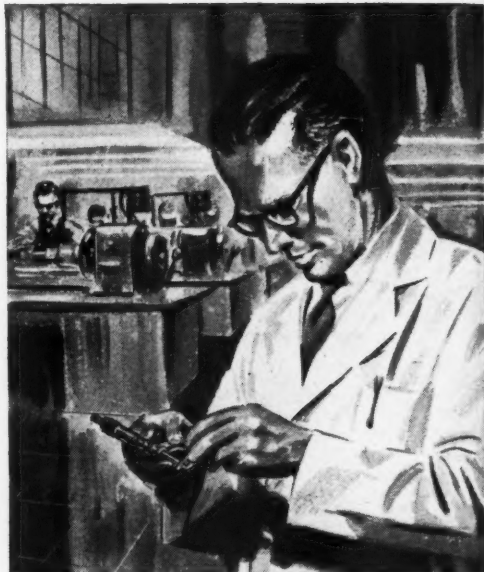
Telephone WESTERN 8077 (8 lines) Telegrams ACCURATOOL HAMMER LONDON

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Weekends

this gardener produces some of the finest vegetables in his allotment society. Like many others with his experience, he swears by Spear & Jackson tools!



Weekdays

he's foreman of a toolroom with a reputation for producing tools that give consistent high performance—using Spear & Jackson tool steels of course!

For the same reasons that experienced gardeners and woodworkers place such confidence in Spear & Jackson tools, *you* can trust Spear & Jackson Tool Steels consistently to give you what you want. Telephone Mr. Steel at Sheffield 20202 and tell him what you *do* want!



SPEAR & JACKSON

TOOL STEELS TO TRUST

Other products include: Segmental Saws • Hot Saws • Friction Saws
 Hacksaws • Metal Cutting Bandsaws • Fusion Bends • Tungsten Carbide
 Tipped Saws and Cutters • Machine Knives • Ground Flat Stock

OA/6840
AETNA WORKS, SAVILE STREET, SHEFFIELD Tel: 20202

When answering advertisements kindly mention MACHINERY.



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THREAD

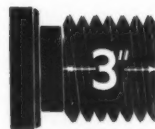


GRINDERS give

you toolroom precision plus production line speed.

Traverse grind as fine as 20 BA or leads as coarse

as 12" Plunge grind threads



3" long

in a turn and a half



Wheels formed by

multi-rib



or single-rib



diamond dressers

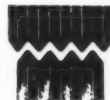
or manual



or automatic



crushing



units.

Furthermore, crush formed wheels

are ideal for grinding intricate



profiles.

Coventry Gauge & Tool Co. Ltd., the world's foremost manufacturers of Thread Grinding Machines, build a wide range to handle work extending from the finest threads used in instrument manufacture up to a maximum capacity of 24" diameter by 90" long. These machines, which produce accurate threads faster and

more economically than by thread milling, embody the latest advances in toolroom and production thread grinding techniques and are backed by many years' research and development. If your production includes threads, worms or forms we will be pleased to submit a detailed quotation against your enquiry.

ROCKWELL
MACHINE TOOL CO. LTD.

For further particulars write or telephone TODAY

WELSH HARP, EDGWARE RD., LONDON, N.W.2. TEL: GLADSTONE 0033

ALSO AT BIRMINGHAM - TEL: SPRINGFIELD 1134/5 • STOCKPORT - TEL: STOCKPORT 5241 • GLASGOW - TEL: MERRYLEE 2822

FOR TOOLROOM AND PRODUCTION

NEW

THIEL II7

**Precision Bandsawing
& Bandfiling Machine**

SPEEDS INFINITELY VARIABLE • 50-3000 FT/MIN

20" THROAT

Other Principal



Features

- * 10" maximum work height
- * 24" x 24" table swivels 30° to right and left, 15° to front and back
- * Compact, clean design
- * Special precision saw guides
- * Rapid changeover from sawing to filing
- * Butt welding unit and grinding wheel enclosed in machine body
- * Original THIEL bandsaws and bandfiles now available.

EARLY DELIVERY

ROCKWELL
MACHINE TOOL CO. LTD.

For further particulars write or telephone TODAY

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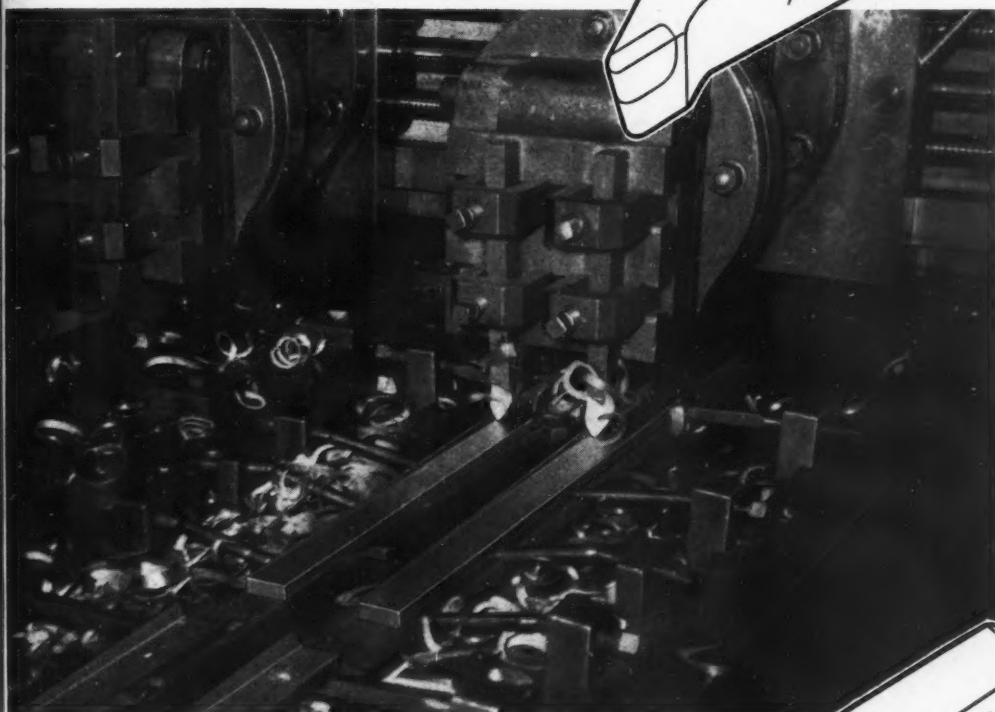
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Ardoloy

An A.E.I. Product

Ardoloy-tipped tools can be supplied for all appropriate machining operations and for those applications where resistance to wear is important.

Ten grades—each for a specific class of work.



Ardoloy grade S 200 planing tools machining jib strips, surface speed 100 ft. per min., $\frac{1}{8}$ " depth of cut, feed .025".

Tools include :—

- LATHE and PLANER TOOLS**
- FACE and OTHER TYPES OF MILLING CUTTERS**
- PRECISION ADJUSTABLE BORING TOOLS**
- THREADING TOOLS**
- TWIST DRILLS, REAMERS and COUNTERBORING TOOLS**

Loose tips supplied to enable customers to tip their own tools



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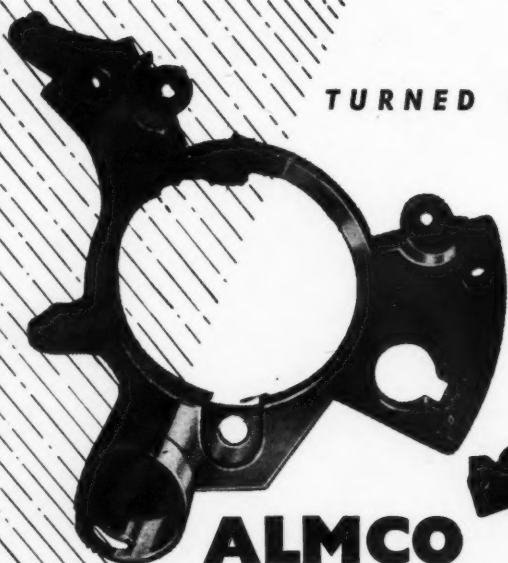
HERBERT

LTD., COVENTRY



AD 611

TURNED OUT FINE AGAIN...



ALMCO SPEED FINISHING GIVES THE SAME UNIFORM FINISH EVERY TIME TEN TIMES FASTER

Using Almco Supersheen barrel-finishing equipment and materials, unskilled operators can turn out precision DEBURRING, DESCALING, BURNISHING, POLISHING, etc., with practically no rejects, with savings of up to 87%, at ten times the speed of hand-finishing.

To prove to yourself that such savings are realities, we invite you to send any unfinished component you choose to our development laboratory where it will be processed **FREE OF CHARGE**. Its finished appearance—together with the detailed report provided—will convince you that Almco products are *essential* in keeping pace with modern production methods. Why not ask us to call? Or, better still, call and see your own products undergoing processing.

ALMCO

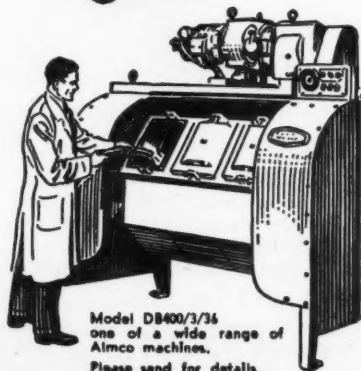
Supersheen

BURY MEAD WORKS : HITCHIN : HERTS

Telephone: Hitchin 3669

A Division of the King Seeley Corporation, Ann Arbor, Michigan, U.S.A.

U.S.A. Almco Division, Albert Lea, Minnesota. HOLLAND (Rotterdam) N.V. Technische Handelssonderneming "Carborundum Aloisite." BELGIUM & LUXEMBURG (Bruxelles) Technometal Societe Anonyme. SWEDEN (Stockholm) Trumlingsaktiebolaget. SWITZERLAND (St. Gallen) L. Kellenberger & Co. SOUTH AFRICA (Johannesburg) Barry Coirne & Co. (Pty.) Ltd. AUSTRALIA & NEW ZEALAND (Melbourne) Hardie Trading Ltd.



Model DB400/3/36
one of a wide range of
Almco machines.
Please send for details.

When answering advertisements kindly mention **MACHINERY**.

Vauxhall

**BALANCE TRANSMISSION BRAKES
FOR 'BEDFORD' TRUCKS
... ON**

JACKSON-BRADWELL

DIRECT—INDICATING

ELECTRONIC

DYNAMIC

BALANCING

MACHINES



This JACKSON-BRADWELL electronic dynamic balancing machine, engaged on transmission brakes at Vauxhall Motors Ltd., checks, records and shows the position of unbalance automatically. The built-in drill is then used to remove surplus metal. There are JACKSON-BRADWELL balancing machines for every duty, to handle components and assemblies from the smallest to the largest sizes. Consult us on your own balancing problem.

JACKSON & BRADWELL LIMITED., Grove House, Sutton New Road,
Birmingham 23

Telephone: ERDington 7411/2

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BALANCING FOR THE TRADE

We can offer Balancing capacity on Jackson-Bradwell Balancing equipment for weights from 5 lb. to 600 lb. and lengths up to 5 ft. All work is carried out promptly by experts at reasonable prices. Send us your enquiries.

BALANCING & TECHNICAL SERVICES

GROVE HOUSE, SUTTON NEW ROAD, BIRMINGHAM, 23
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Of Course there
is an **EASIER**
way . . .



the **CURVIT** bending & coiling machine

Unmatched coiling and forming versatility and operational ease. Set-up is simple. Just install the correct rollers, adjust the radius feed, set the pitch and that is all. **One set of form rollers required for each size of stock, the same set being used to obtain any radius.** Models range in sizes to handle from $\frac{1}{8}$ " up to 4" dia. stock for forming into circles, squares, triangles and many other shapes. Machines readily automated to make constant or programmed adjustments without feed interruptions.

A wide range of machines for coiling and bending pipe, tube, flat stock and solid bars from $\frac{1}{8}$ " up to 4" dia.

Write for complete information.



FUNDITOR LTD.

3, Woodbridge Street, London E.C.1
CLERkenwell 6155/7

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GRAZIANO

SAG 180 *centre lathe*

- ★ Bedways hardened and ground
- ★ Spindle fitted with gamet bearings
- ★ Cam-lock spindle nose
- ★ Swings 19½" in gap without removal of gap-block
- ★ Hardened and ground gears

Swing over bed	14"
Swing in gap	19½"
Distance between centres ...	40" - 60"
Spindle speeds	
(9) 45-1,500 or 54-1,800 r.p.m.	

PLEASE SEND FOR FULL DETAILS

ELGAR

MACHINE TOOL COMPANY LIMITED

172-178 VICTORIA ROAD · ACTON · LONDON W3 · Telephone ACORN 5555

MIDLANDS SHOWROOM: 1075 KINGSBURY ROAD, ERDINGTON, BIRMINGHAM 24. Tel: Castle Bromwich 3781/2
Sole Scottish Agents: Angus & Crichton (Sales) Ltd., 7 Midland Street, Glasgow C.I. Telephone: City 4560

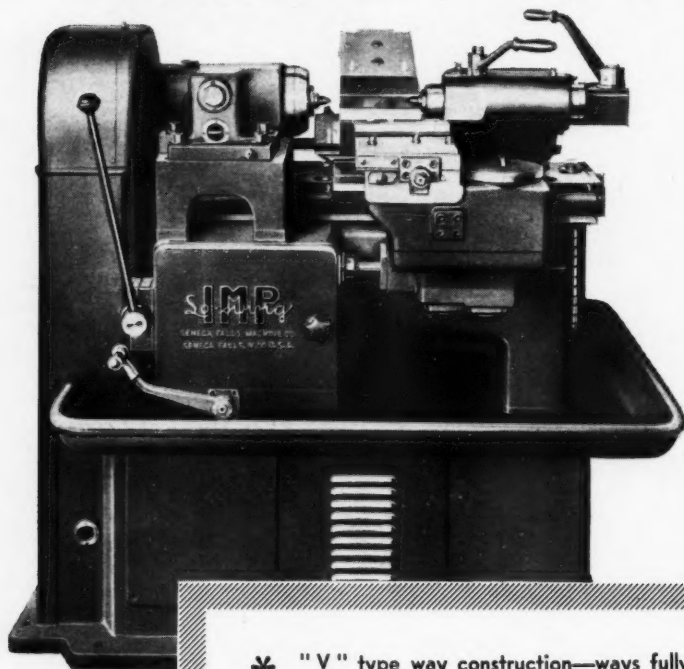
NRP 3474

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SENECA FALLS

Lo-swing

IMP

AUTOMATIC
LATHE

** Check
these five
features!*

- * "V" type way construction—ways fully protected.
- * 5,000 r.p.m. spindle and belt driven headstock prevents vibration at high speeds. 5 h.p. motor drive.
- * Rapid traverse rate and short set-up time.
- * Dial set lost-motion mechanism and cam feed.
- * Air operated clutch and brake on main drive motor.
- * Third Slide can be furnished for additional facing, grooving and chamfering operations—roughing or finishing.

GASTON E. MARBAIX LTD.

Devonshire House, Vicarage Crescent, Battersea, S.W.11.

Phone: Battersea 8888 (8 lines)

1961



lines)



PLAUERT-WETZEL

Horizontal Boring and Milling Machine



- Boring and milling spindles can be engaged individually or together, at identical or different speeds.
- Pre-selection of a wide range of spindle speeds and feeds, controlled from pendant station.
- Precision scales for co-ordinate settings, Optical fine setting equipment available as an extra.
- Rapid tool clamping in boring spindle by steep angle taper and quick-acting locknut.
- Adjustable, hardened outboard supports for the table slide; included as standard equipment.
- Fully automatic, timed lubrication of slideways, feed mechanism and spindles.

Brief description Model BFn 100

Table dimensions	50 in. x 55 in.
Table load, max.	8 tons
Distance between faceplate and steady	124 in.
Height of work spindle above table	0-55 in.
Cross and longitudinal traverse of table	69 in.
Boring spindle diameter	3.94 in.
Milling spindle diameter	7.09 in.
Boring depth in one traverse/with resetting	35/49 in.
Maximum diameter bored	35 in.
Facing diameter, max.	44 in.
Spindle speeds	9-1400 r.p.m.
Rapid traverse (all directions)	138 in./min.
Main motor	20 HP.
Weight (net, with steady)	17 tons

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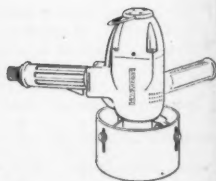
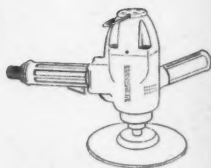
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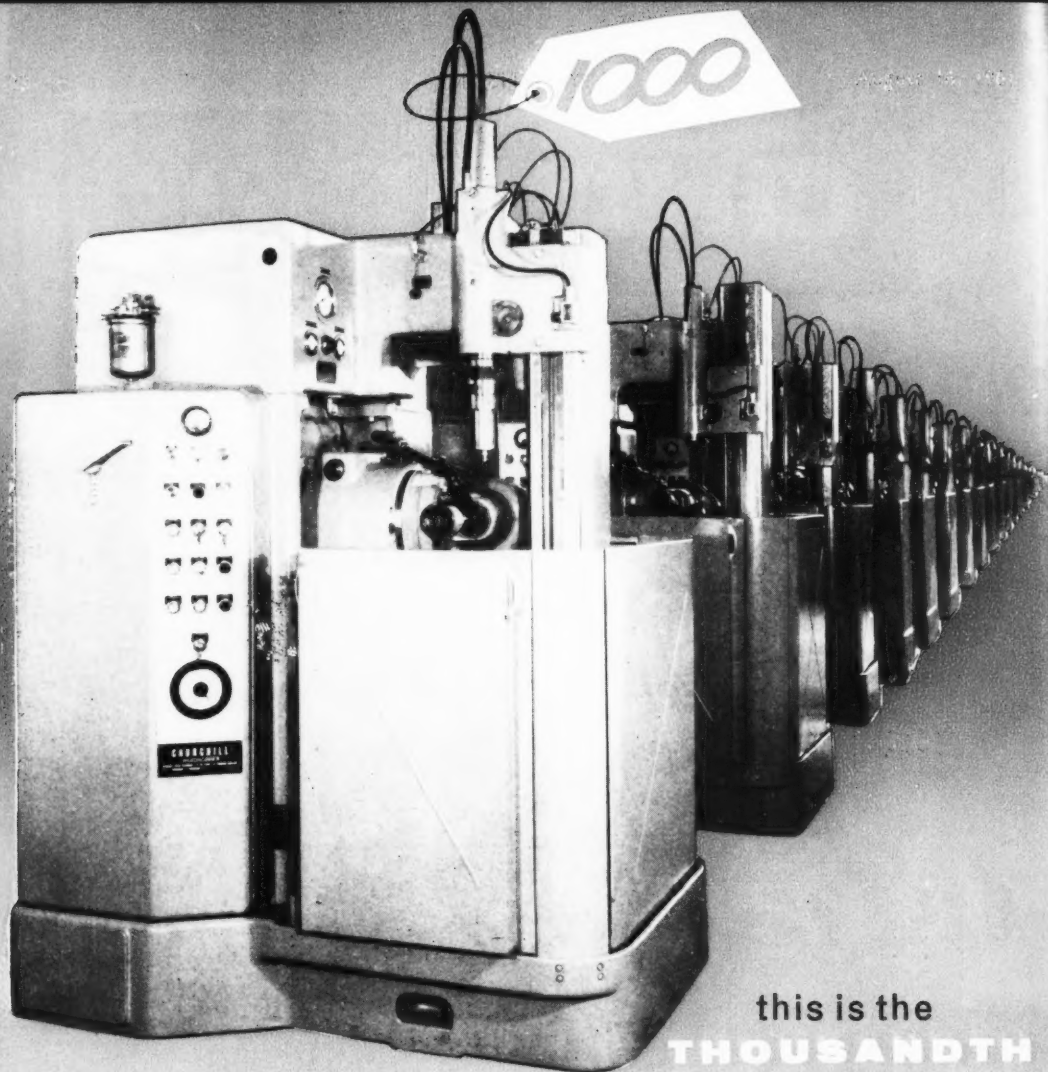
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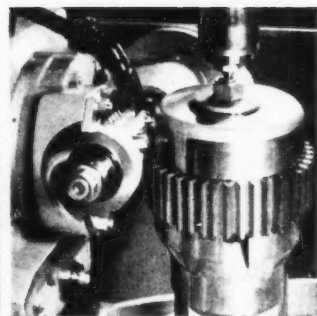
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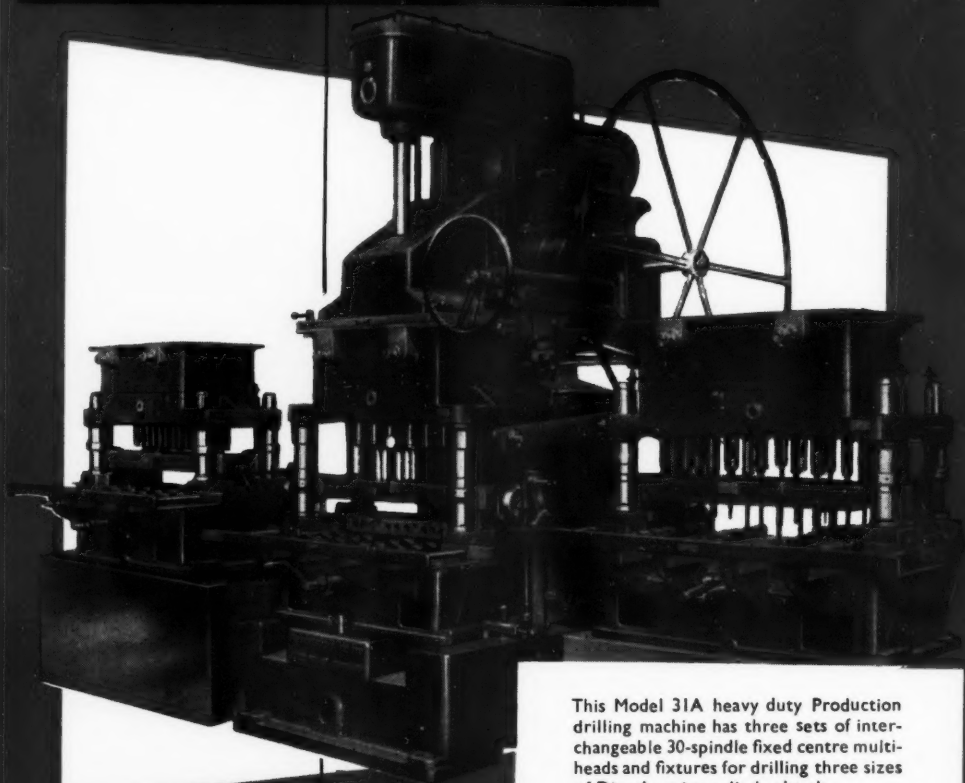
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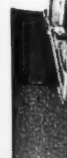
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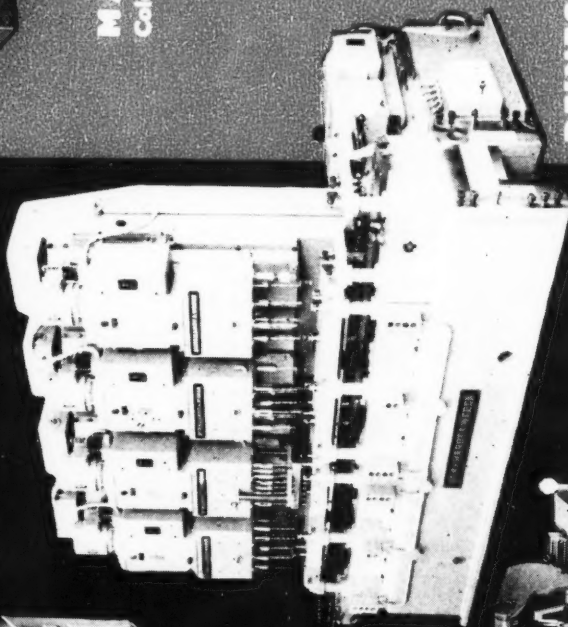


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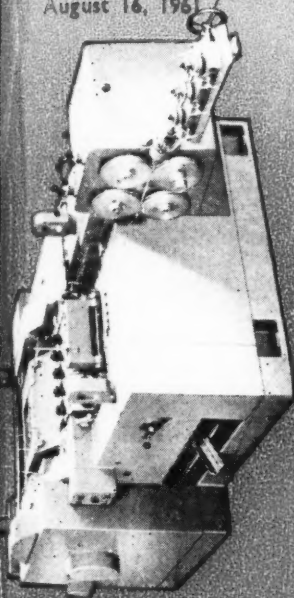
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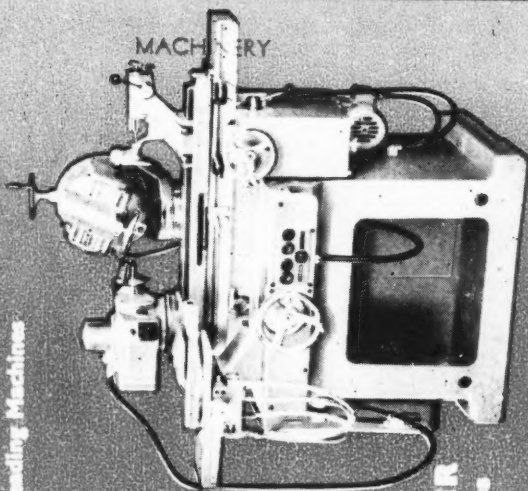
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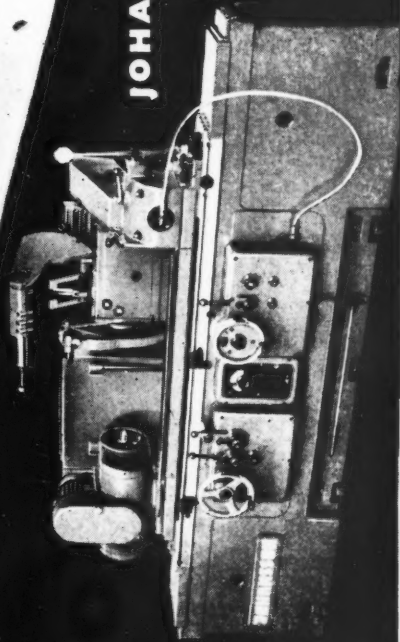


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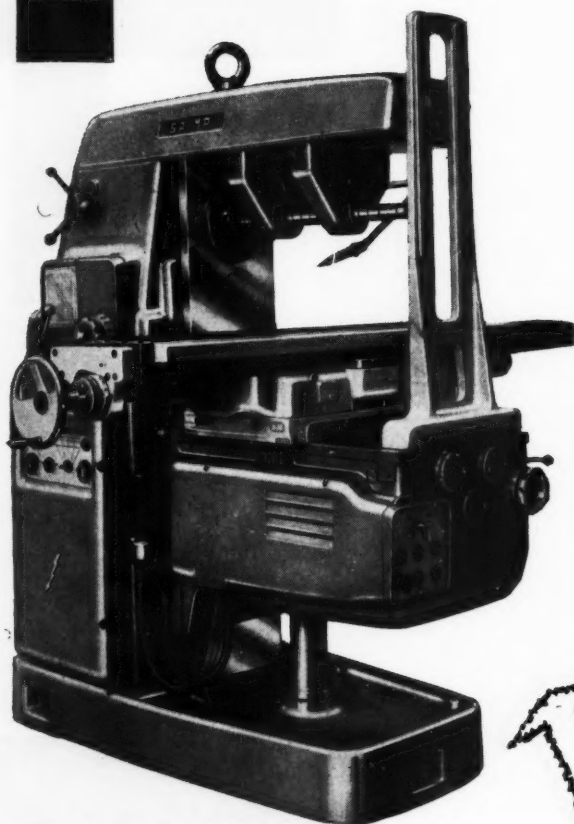
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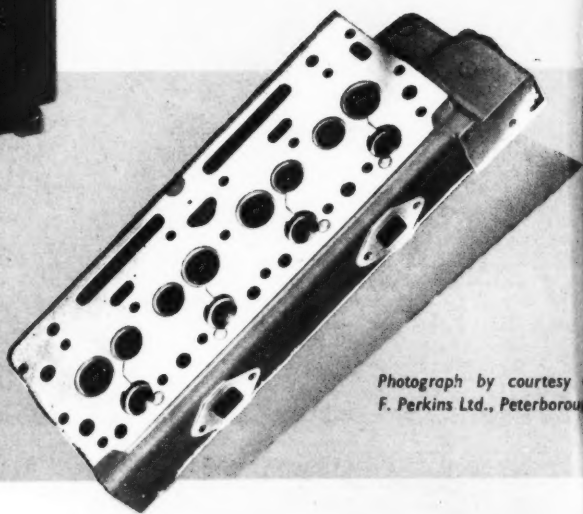
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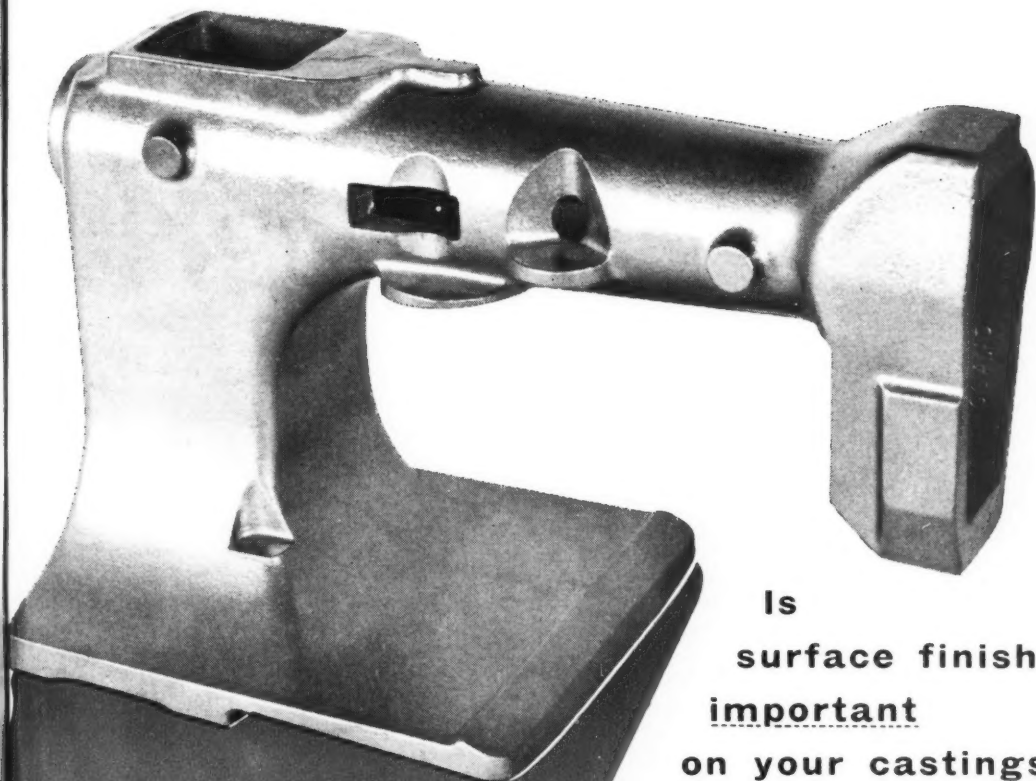
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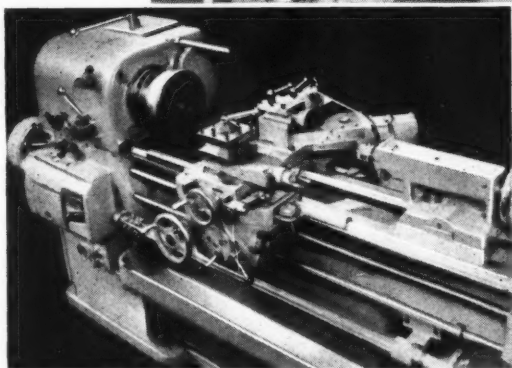
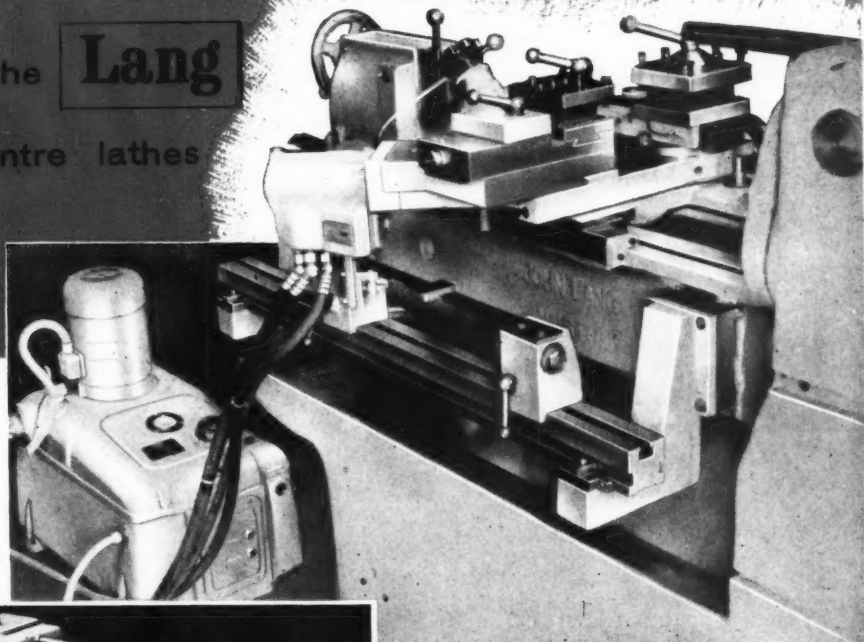
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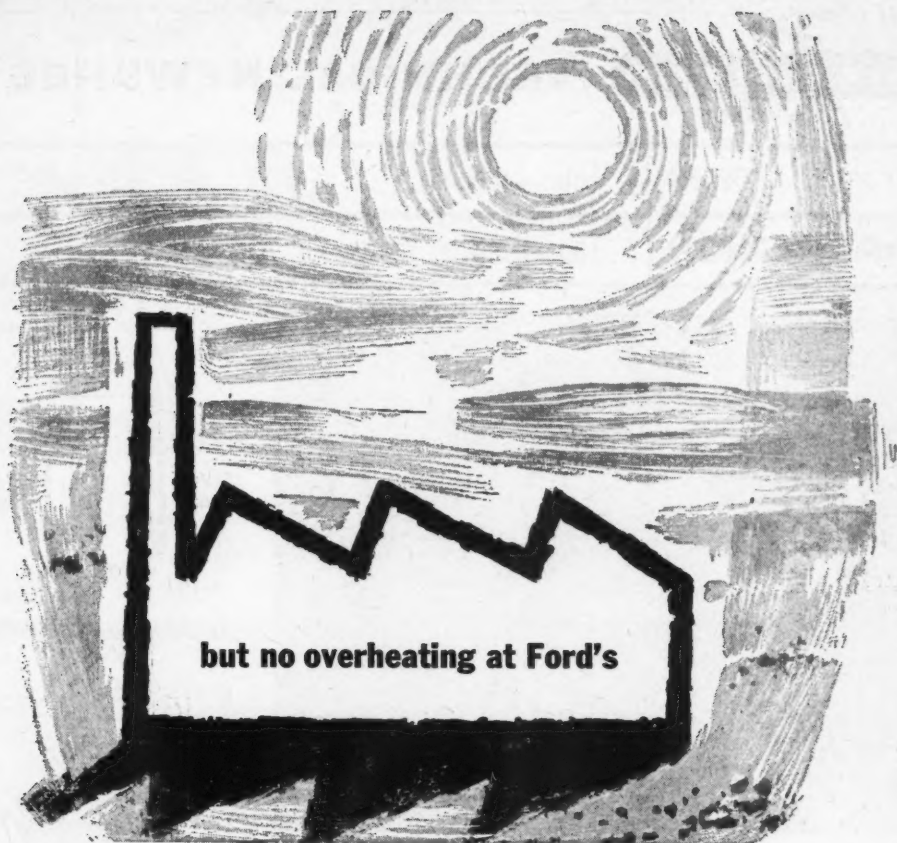
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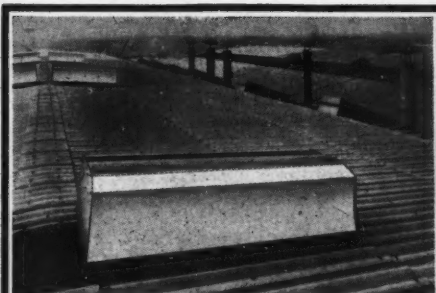
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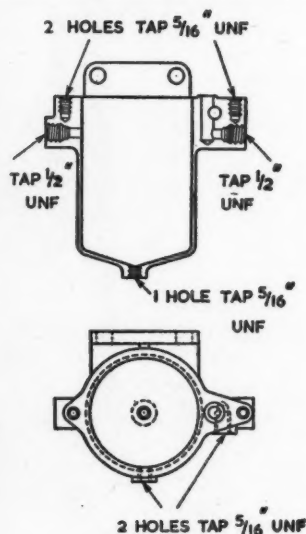
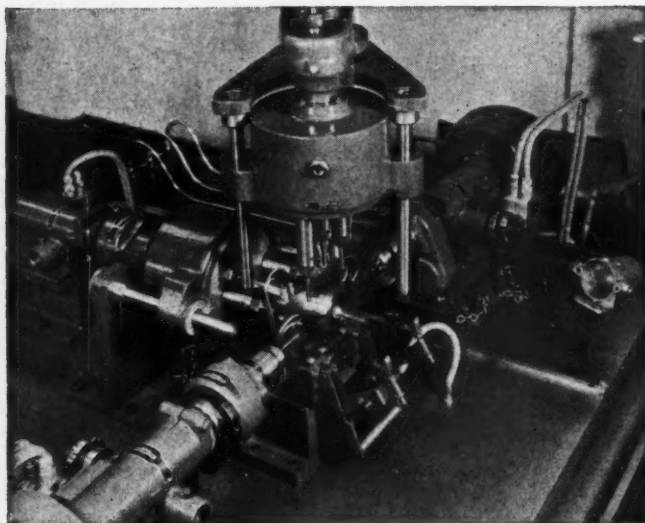
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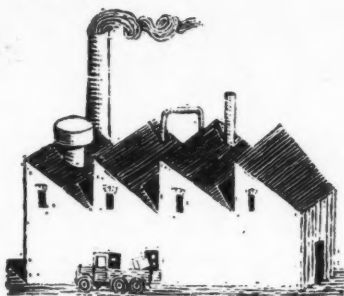
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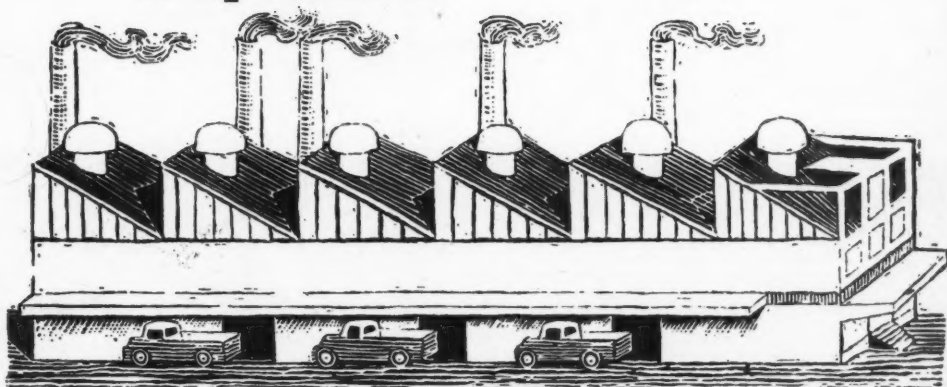
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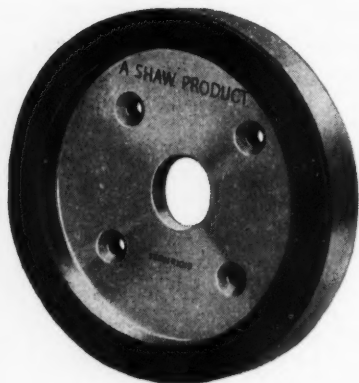
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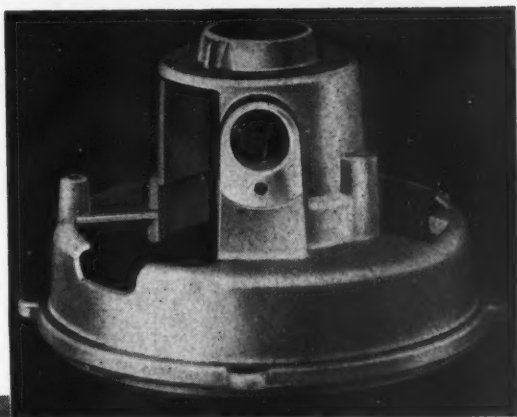
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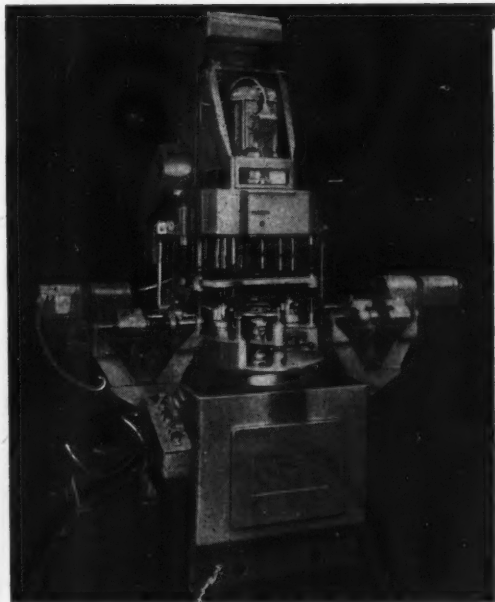
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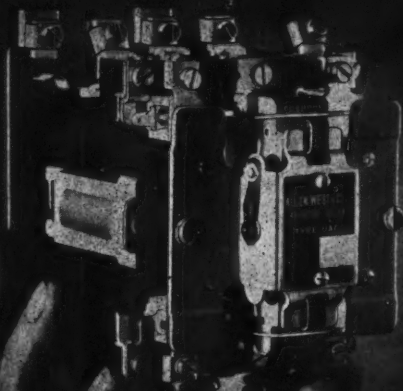
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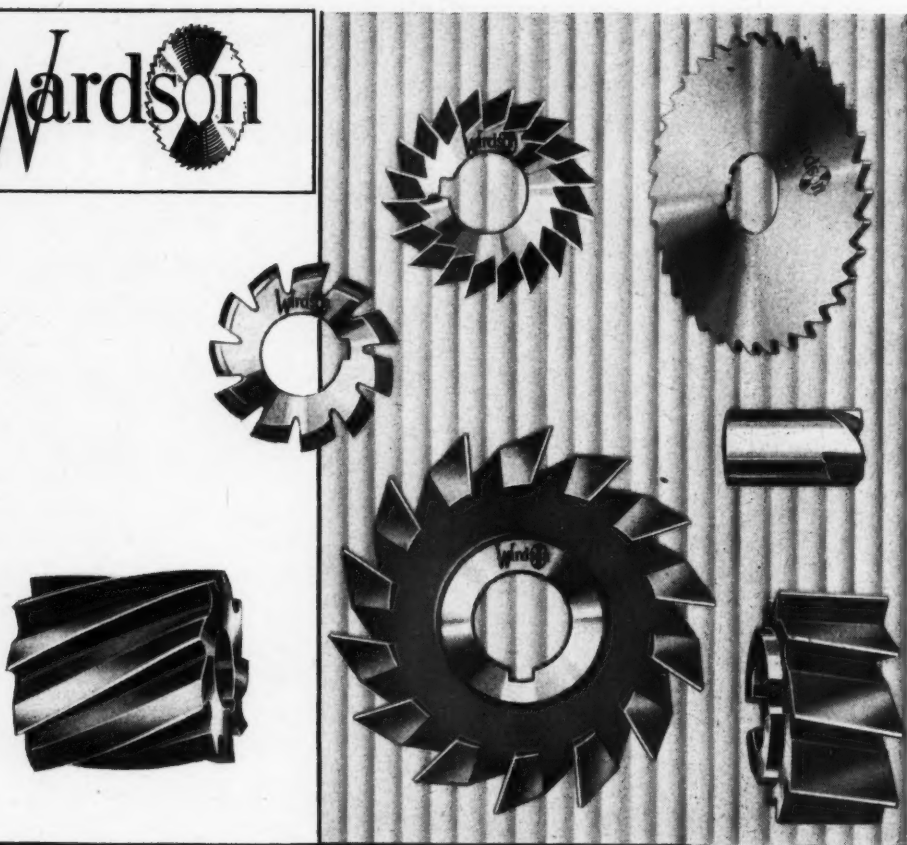
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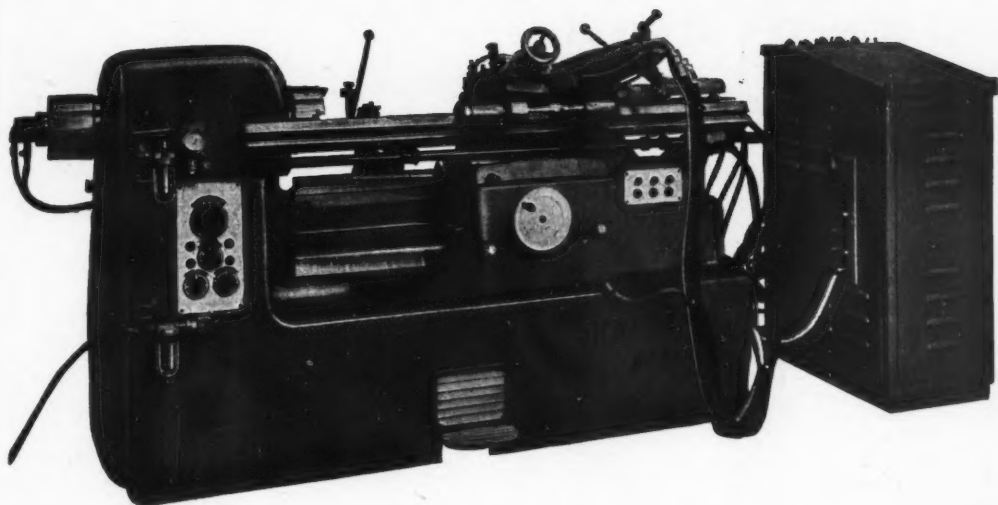
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Number of feed rates to copying slide	..	48
Max. tool pressure	..	1,300 lbs.

EARLY DELIVERY

DAILY DEMONSTRATIONS AT OUR WORKS:

**HERBERT WIDDOWSON & SONS LIMITED
CANAL STREET WORKS NOTTINGHAM**

TELEPHONE: 51891 (3 lines)

TELEGRAMS: TOOLS NOTTINGHAM

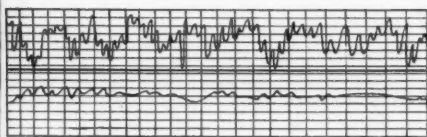
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PRESTO

reamers

cost no more
ream smoother holes
and last longer

'Superfinished'
to 2 micro inches



Surface finish
reading from
bore with a
standard finish
Reamer.

Note improved
surface finish
obtained from
PRESTO
'Superfinish'
Reamer.

The cutting lands of PRESTO 'Superfinish' Reamers have a surface finish to 2 micro inches—thus ensuring improved finish in the holes produced and increased tool life through resistance to metal pick-up. PRESTO 'Superfinish' Reamers are supplied at no extra charge and are available in hand and machine types in sizes 5/16" to 1".



PRESTO

PRESTO tools are made by:-

EASTERBROOK, ALLCARD & CO. LTD.

PENISTONE ROAD, SHEFFIELD, 6
Telephone : 348931

LONDON STOCKS:-
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Phone: HOP 4511-4

BIRMINGHAM STOCKS:-
EAST INDIA HOUSE, HELENA ST., PARADE, 1.
Phone: CENTRAL 6997 & 6880.

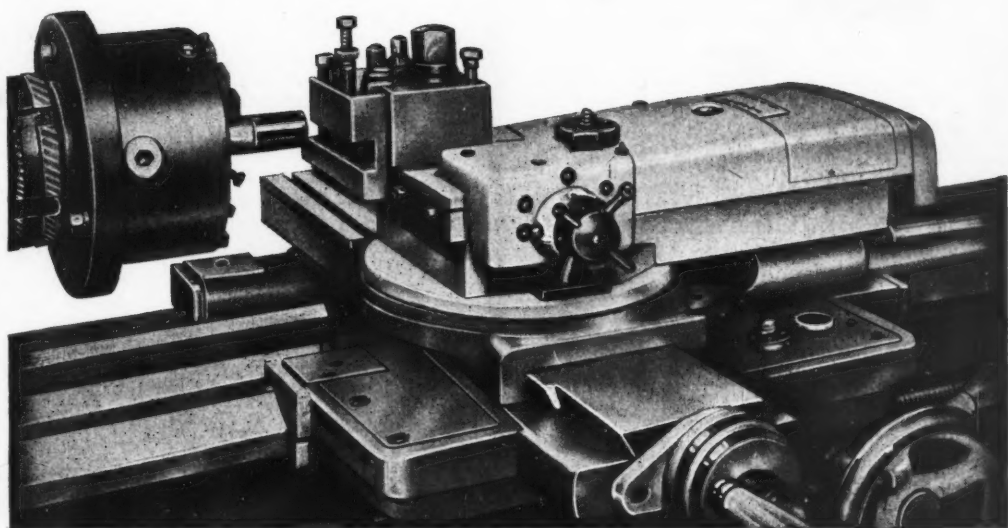
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high speed THREAD CUTTING ATTACHMENT



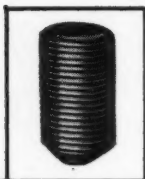
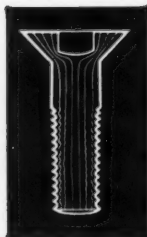
**Write today
for complete
details of this
revolutionary
attachment**



- ▶ FITS ANY CENTRE LATHE
- ▶ CUTS ANY THREAD...
INTERNAL OR EXTERNAL
CYLINDRICAL OR TAPER
- ▶ MAXIMUM LENGTH 1½ in.
MAXIMUM PITCH 5. T.P.I.
- ▶ THREAD RIGHT UP
TO A SHOULDER...
INSTANT WITHDRAWAL
- ▶ EQUALLY SUITABLE FOR
SHORT RUNS OR
LARGE SCALE PRODUCTION

HERBERT WIDDOWSON & SONS, LTD
CANAL STREET WORKS · NOTTINGHAM · ENGLAND

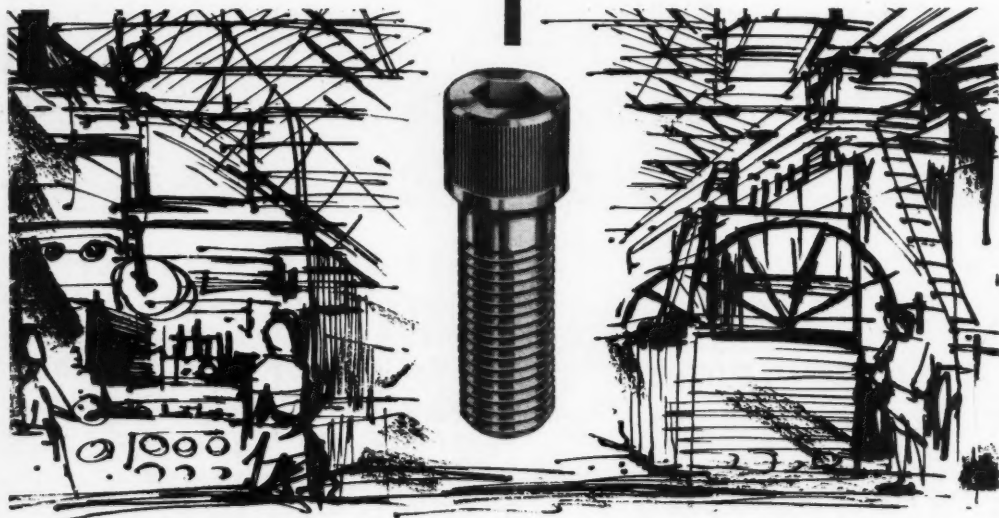
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Unbrako high-performance socket head cap screws are made in a vast range of sizes and threads to cover every need. A descriptive brochure is yours for the asking.

Performance is measured by true dimensions

Research, craftsmanship and rigorous control combine to make Unbrako screws the world's safest, each produced with that unerring dimensional accuracy which ensures unfailing performance. Dimensional accuracy includes the dimension which can only be measured in retrospect. The dimension of in-built performance. Millions of Unbrako screws have been proving this for years.



UNBRAKO

UNBRAKO SOCKET SCREW CO LTD COVENTRY TEL: 89471

ALSO MAKERS OF: CAP SCREWS • BUTTON HEAD SOCKET SCREWS • COUNTERSUNK SCREWS • PRESSURE PLUGS • RING
BOLTS • SET SCREWS • SHOULDER SCREWS • SQUARE HEAD SET SCREWS • T BOLTS • T NUTS • SEL-LOK • STAINLESS STEEL AND COLLARS
UNBRAKO SCHRAUBEN Gm. b. H. KOBLENZ • UNBRAKO STEEL CO. LTD., SHEFFIELD, ENGLAND

**Superb
performance
Attractive
price
Quick
delivery**

All models complete with Standard Equipment including :

- Cos-par Universal Dividing Head
- Vertical Milling Attachment
- Arbor
- Front Support Braces

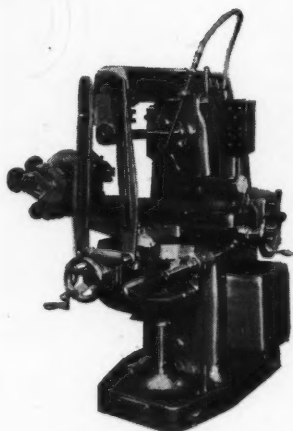
Specification :

Model	No. 0	No. 1	No. 2
Table	34" x 8½"	39½" x 9"	48" x 11"
Long. Trav.	20"	26"	29"
No. of Speeds	12	9	18
Speeds R.P.M.	32-1000	60-1200	40-2000
Spindle Nose	No. 40	No. 40	No. 40
PRICE ★	£880	£1100	£1825

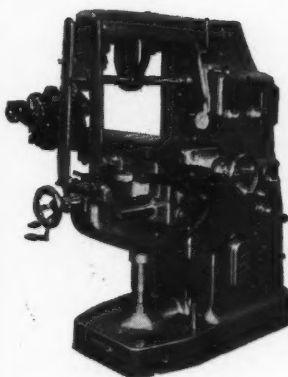


UNIVERSAL MILLING MACHINES

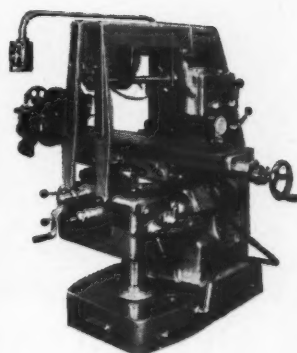
Model 0



Model 1



Model 2



★ Special terms
for members of
B.A.M.T.M.

HERBERT WIDDOWSON & SONS LIMITED

Canal Street Works, Nottingham. Tel: 51891 (4 lines) Grams: TOOLS, NOTTINGHAM

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...and you can make your own die sets - but
it's better to buy from *Desoutter*

DESOUTTER BROTHERS LIMITED, 121 HAY LANE, KINGSBURY, LONDON NW9

CRC 115

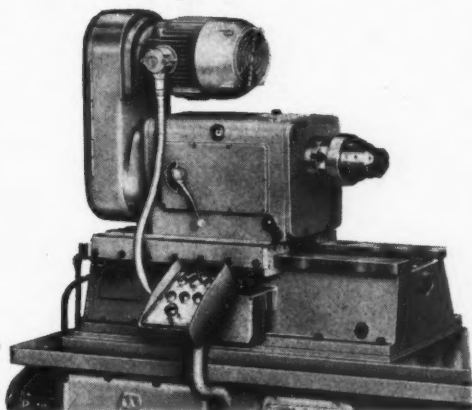
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BERARDI

A name in Europe synonymous with

AUTOMATION

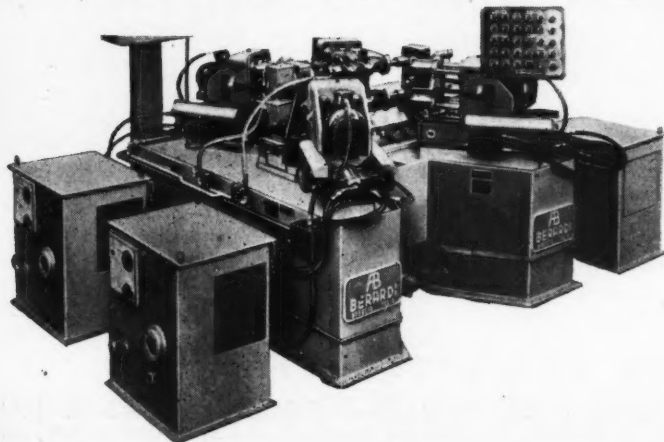
- Electro-Hydraulically Controlled
- Flexibility with standardisation of Units
- Handling reduced to minimum
- Consistent Production



Our Development Engineer always available for discussion

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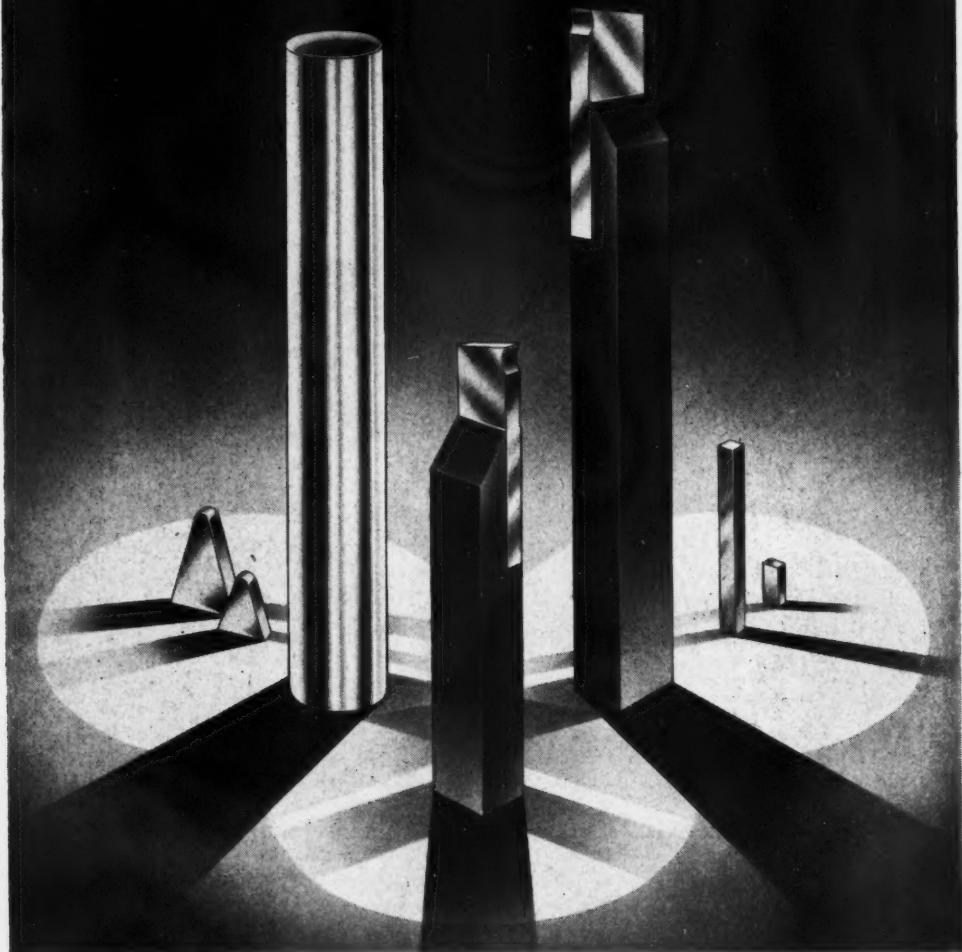
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WORKS
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NOTTINGHAM

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"STELLITE" 100



"Stellite" 100 is a medium priced cutting alloy which is tougher than carbide and gives greater production than high speed steel. It is used for machining practically all metals and materials and excels at machining stainless, heat resistant and high tensile steels. It is a high production alloy which can be ground on normal grinding wheels.

Write for our publication B.14 which gives further details.

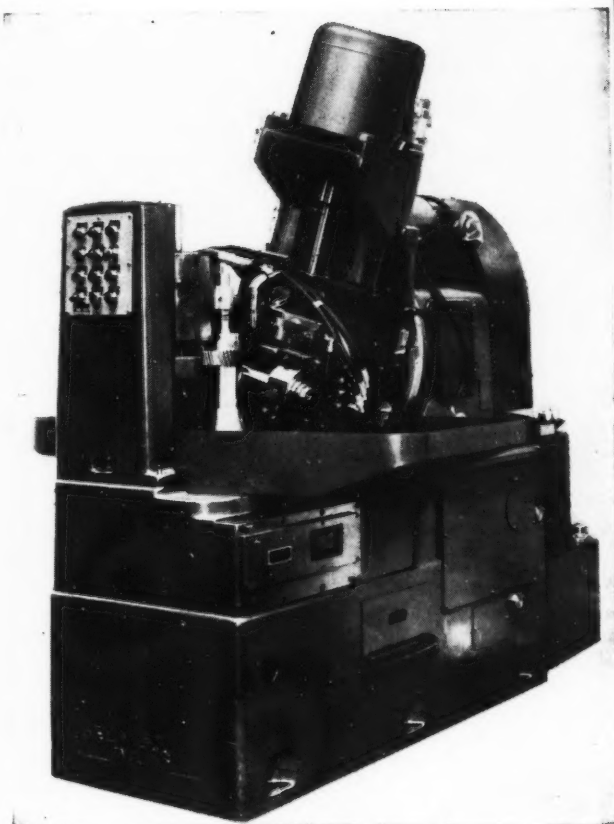


DE LORO STELLITE LIMITED • STRATTON ST. MARGARET • SWINDON • WILTSHIRE
DE LORO STELLITE (DIV. OF DE LORO SMELTING & REFINING CO. LTD.) BELLEVILLE • ONTARIO • CANADA
AD. NO. 348

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1961

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'HOBlique' GEAR HOBBING MACHINE

Manufactured under licence from the Norton Company (Gould & Eberhardt Division), U.S.A. by Drummond Brothers Limited.

The 12in. *HOBlique* is a completely new spur and helical gear hobber with a fully automatic cycle and has been compactly designed, with vertical work axis, to meet the demands for high speed, heavy feed, mass production of transmission gears, chiefly in the automobile industry and for other applications where quantity production of medium and medium-coarse pitches is required.

The rigid construction allows fullest advantage to be taken of semi-finishing at high speeds with multiple thread hobs and finish cut gears with angle thread hobs can be produced both accurately and economically.

The principle of moving the hob slide through the oblique plane when cutting helical gears has dispensed with leadscrew, differential gearing, guides and cams and simplifies set up procedure since no gear calculations are required.

DRUMMOND BROS. LTD.
GUILDFORD ENGLAND

Member of the Asquith Machine Tool Corporation

MACHINE SPECIFICATION

Maximum rated Diametral Pitch in Steel	..	..	5 D.P.
Maximum Centre Distance, Hob to Work	..	..	9in.
Minimum Centre Distance, Hob to Work	..	..	1½in.
Maximum Diameter Gear with 6in. Diameter Hob	..	..	12in.
Maximum Travel of Hob Slide	..	..	8in.
Maximum Hob Swivel Left and Right Hand	..	..	45°
Maximum Diameter of Hob	..	..	6in.
Main Motor h.p.	..	..	10

Sales and Service for the British Isles

DRUMMOND-ASQUITH LIMITED

Member of the Asquith Machine Tool Corporation

KING EDWARD HOUSE, NEW ST., BIRMINGHAM Phone: Midland 3431. Also at LONDON Phone: Trajalgat 7224 & GLASGOW Phone: Central 0922

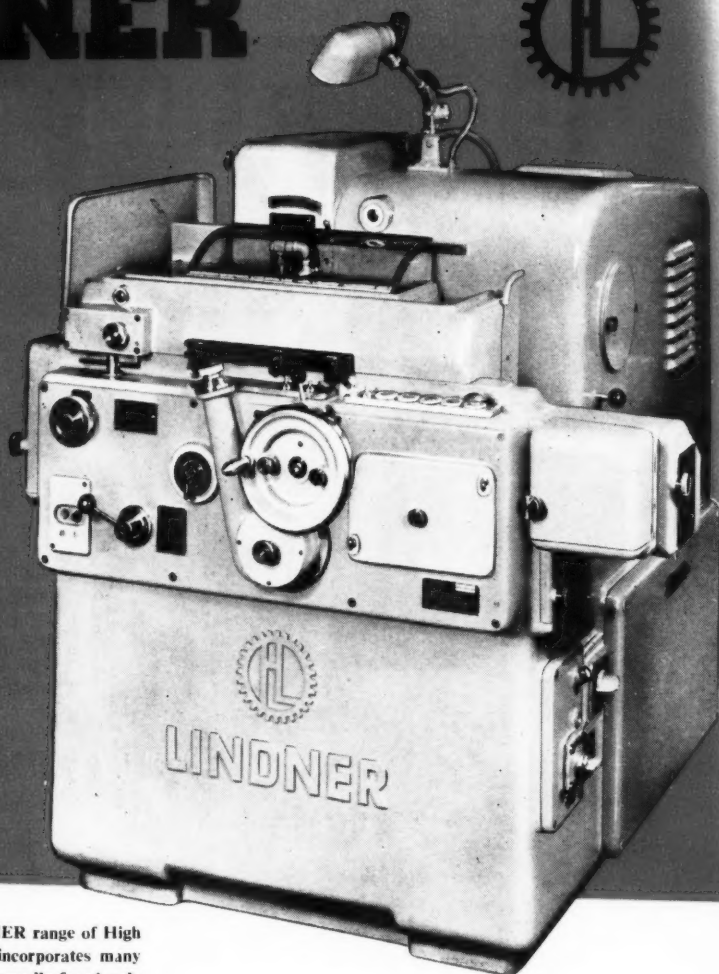
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LINDNER GE

**'MAXIMUM
SIMPLICITY...**

**MAXIMUM
ECONOMY'**

**THREAD
GRINDING
MACHINE**



This smallest machine of the LINDNER range of High Precision Thread Grinding machines incorporates many of the famous LINDNER features normally found only on larger and more expensive machines.

Two models of this highly efficient machine are available

Model A: High Precision Thread Grinding Machine of highest accuracy for the grinding of external threads and annular forms, employing either the single or multi-rib wheel, particularly suitable for producing thread plug gauges, measuring and micrometer screws.

Model B: As Model A but with a relieving attachment intended for the production of both straight and spiral fluted taps, and also gives excellent results when used to produce highly accurate threads on small component parts.

Both models will accommodate up to 1in. (25 mm) diameter by 7½in. (190 mm) long

Maximum length of thread ground 3½in. (90mm)

Maximum swing over table 2¾in. (60 mm) wheel diameter 20in. approx. (500 mm).

Provision is made for grinding threads of perfect form from 200 to 6 TPI (125 mm to 4 mm pitch)

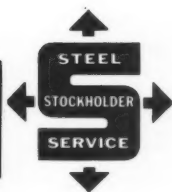
STEDALL
MACHINE TOOL CO.

192-204, PENTONVILLE RD, LONDON, N.1

Telephone: **TERminus 3699**

Also at MANCHESTER · LEICESTER · BRISTOL · GLASGOW

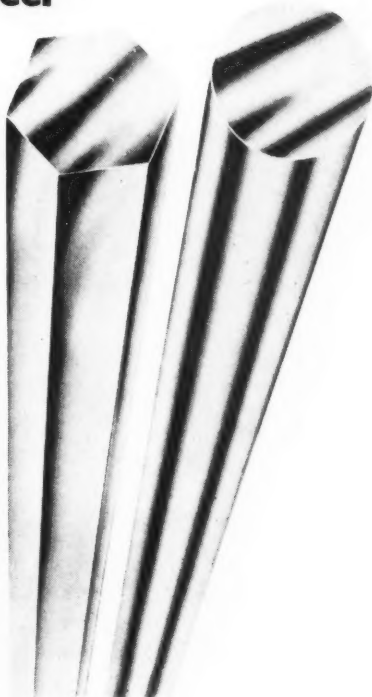
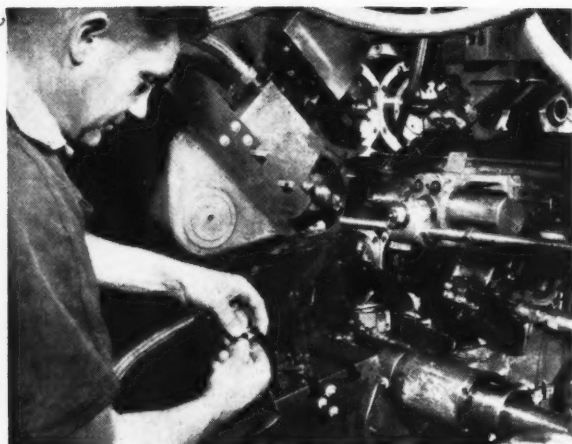
MACREADY'S USALED



Leadbearing freecutting bright steel

B.S. 970 1955 En. 1.A.

The addition of 0.15—0.35% lead alloy to Usaspead freecutting steel, produces USALED, a leadbearing, freecutting bright steel specially for use with automatic lathes. Cutting speeds can be increased by up to 25% more than normal freecutting steel, and output can be increased by an amount equal to a working day per week.



MACREADY'S

SUPERLED

Leadbearing freecutting bright steel

B.S. 970 1955 En. 1.B.

The newest addition to the Macready range of freecutting steels has a higher machinability index than any other analysis of steel, and its use on modern automatics produces parts which previously could only be machined economically from brass.

Full descriptive literature is available on request.

A complete range of steels to B.S. 970 : 1955 (En Series) is available.

Produced specifically
for capstans and autos

14th ENGINEERING EXHIBITION 1961



MACREADY'S METAL COMPANY LIMITED USASPEAD CORNER,

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Telephone: TERminus 7060 and 7030 (30 lines)

Telegrams: Usaspead, London, Telex. Telex No. 22788.

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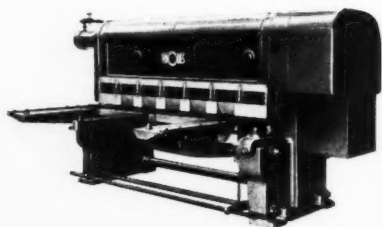
RHODES

patented

SERIES

A

FLUID DRIVE SHEARS

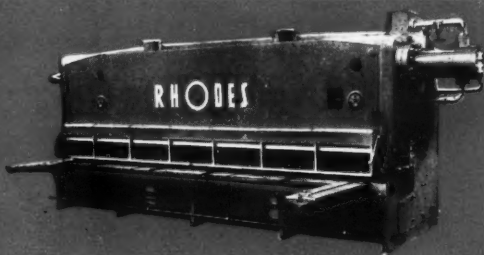


Capacity to $\frac{1}{8}$ "; effective length of cut from 6 ft. to 16 ft. according to machine size.

SERIES

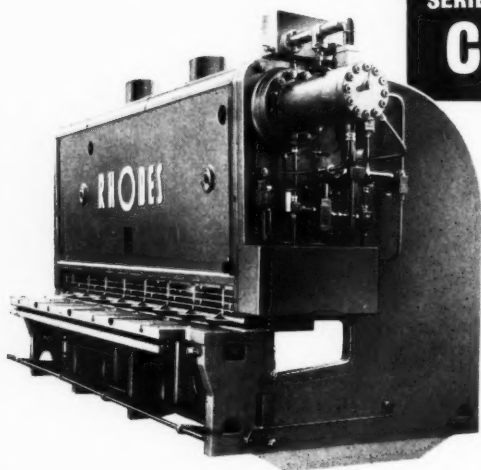
B

Capacity to $\frac{1}{4}$ " and $\frac{3}{8}$ ", length of cut 6 ft. to 16 ft. according to machine size.



SERIES

C



In this series, machines are made with capacities respectively of $\frac{1}{2}$ ", $\frac{5}{8}$ " $\frac{3}{4}$ " and 1" thick, with length of cut from 6 ft. to 16 ft. according to machine size.

.....*You can ^hsave with these shears!*

PRECISION

Seven essential features enable Rhodes to cut with an accuracy previously unknown — ROBUST CONSTRUCTION permits swift, smooth action — OVERLOAD RELEASE — eliminates excessive strain and prevents misalignment, — BLADE GUIDANCE — designed to reduce stress — avoids distortion — BLADE RAKE — reduces twisting of narrow strips — HOLD DOWN — materials are gripped firmly *before* shearing starts — GAUGING — equipment covers most exacting requirements.

INCREASED PRODUCTIVITY

The stroke of an ordinary mechanical shear is effected by the revolution of the crankshaft. Therefore the number of revolutions of the crankshaft possible per minute gives the number of strokes per minute. This is quite satisfactory — BUT ONLY WHERE ALL STROKES ARE OF THE MAXIMUM POSSIBLE LENGTH which rarely happens in practice. By contrast "RHODES" FLUID DRIVE SHEARS make a stroke not exceeding length of cut — for example — a 12' Shears making 40 12' strokes per minute — the speed for a 6' cut becomes 80 per minute — 3' cut 160 per minute.

BREAKAGE IS IMPOSSIBLE

—Low maintenance built into the design.

Rhodes Fluid Drive Shears are immune from the effects of overloads — breakage is now impossible. Components and assemblies which normally demand frequent repair are a thing of the past — NO CLUTCH, NO BRAKE, NO ROTATING SHAFTS or BEARINGS.

**OVER 600 OF THESE UNIQUE MACHINES
HAVE BEEN SUPPLIED —
NEVER A MAJOR REPAIR!**

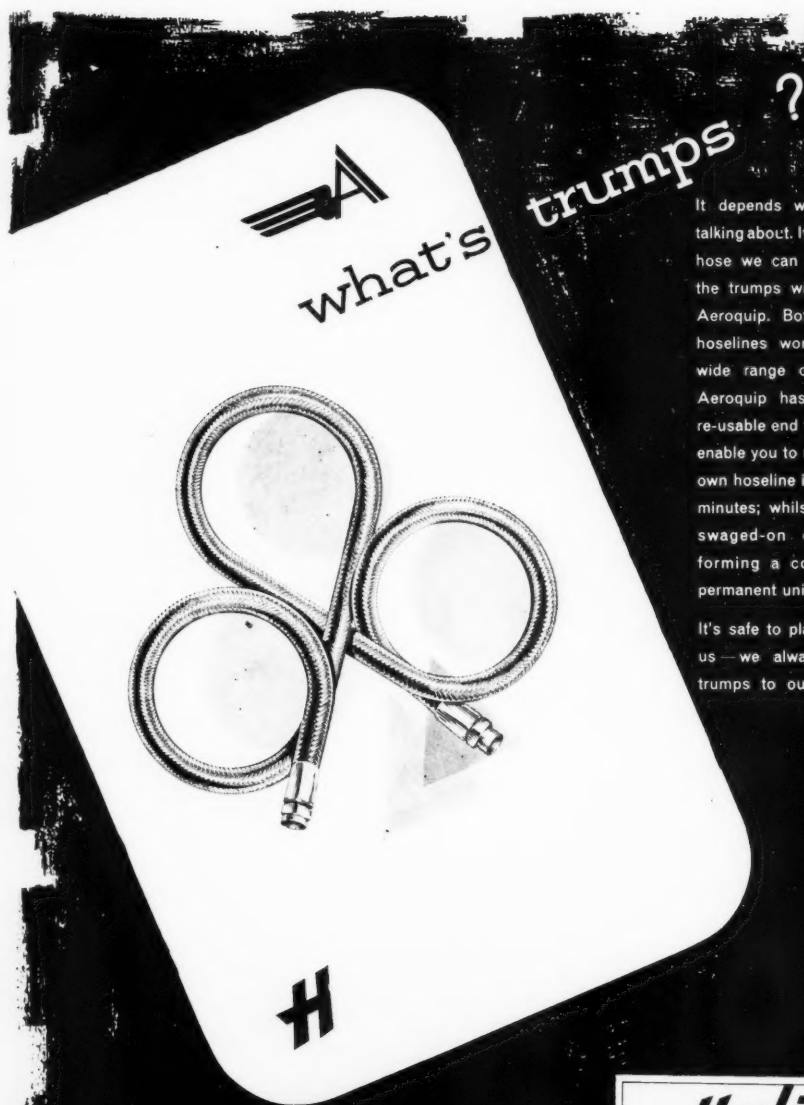
RHODES

**FLUID DRIVE
SHEARS**

JOSEPH RHODES & SONS LIMITED

WAKEFIELD · ENGLAND Telephone: 2756 (3 lines)

LONDON: Norfolk House, Laurence Pountney Hill, E.C.4. Telephone: Mansion House 7746-7747



It depends what you are talking about. If it's hydraulic hose we can deal you all the trumps with Hyline or Aeroquip. Both are flexible hoses working over a wide range of pressures. Aeroquip has detachable, re-usable end fittings which enable you to make up your own hose in a matter of minutes; whilst Hyline has swaged-on end fittings forming a complete and permanent unit.

It's safe to play cards with us—we always deal the trumps to our customers.

Hyline

SUPER OIL SEALS & GASKETS LTD
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Telephone : Kings Norton 2041

Aeroquip

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BROOKE

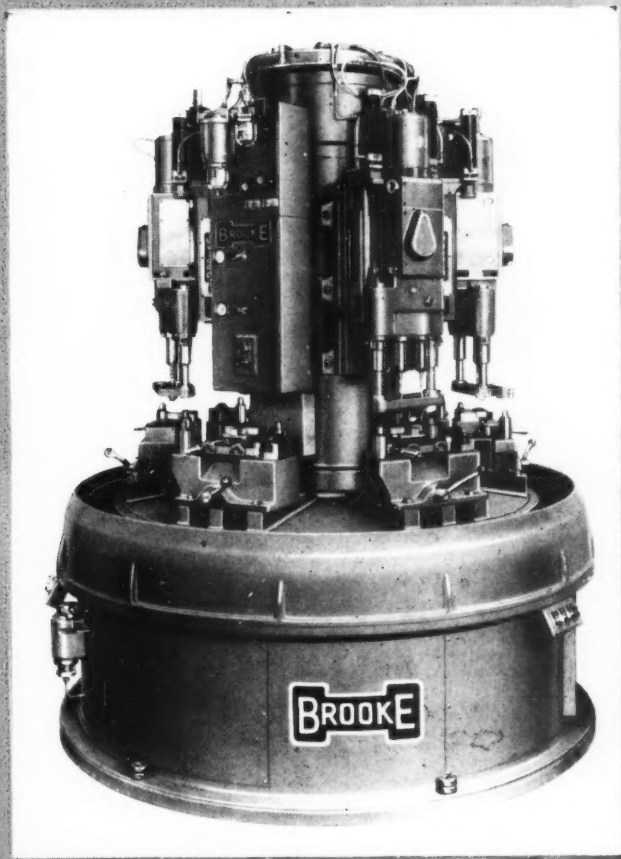
UNIT MACHINES AND UNIT HEADS

A new range of BROOKE Unit Heads and the new CENTRE COLUMN ROTARY INDEXING MACHINE (patents applied for)

Special features on this machine include:—

- ACCESSIBILITY OF HEADS AND TOOLING
- PATENT TABLE-CENTRALISING DEVICE GIVES ACCURACY OF 0.0005in. IN INDEXING AT THE OUTSIDE DIAMETER OF THE 60in. TABLE
- TABLE ON AIR-FLOTATION, HYDRAULIC OR AIR POWERED
- QUICK RE-TOOLING AT LOW COST
- ECONOMIC USE OF FLOOR SPACE

We are exhibiting at the
7th European Machine Tool
Exhibition in Brussels
from September 3 - 12, 1961.
Stand No. 4329
Hall No. 4



BROOKE TOOL AUTOMATION LTD.

CARDINAL WORKS, ALDRIDGE ROAD, PERRY BARR, BIRMINGHAM, 226

Tel: Birchfield 4541/2/3/4.

Meehanite

means
**CASTING
QUALITY**



TAKE ADVANTAGE OF THIS FREE OFFER

For more facts about Meehanite castings, write for any of the bulletins listed below, which will gladly be sent upon request.

- L7 Casting Design—10 basic rules
- L8 Meehanite Casting Properties
- L9 Cut Costs with good Design

When you specify Meehanite—you are getting a high quality casting. Meehanite castings are controlled to give uniform soundness, accuracy and good finish and machinability. You can depend upon Meehanite castings to give you a better performance in service . . . so put this dependability to work for you.



MEEHANITE

THE INTERNATIONAL MEEHANITE METAL CO., LTD., EPSOM, SURREY

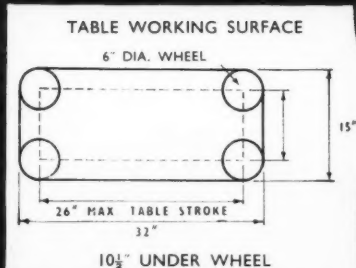
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Traversing head for positioning wheel anywhere on table so that dies can be ground without removing pins. Infinitely variable hydraulic or manual table traverse. Automatic infeed for depth of cut. Guaranteed flatness of work and surface finish to 1.5 micro-inches on suitable materials. Segmental chuck available for maximum stock removal. Automatic pressure lubrication to all parts. Rapid power rise and fall of knee. Large capacity mobile coolant tank with sludge settlement tray.

**HIGH
PRECISION
TOOL & DIE
SURFACE
GRINDER**

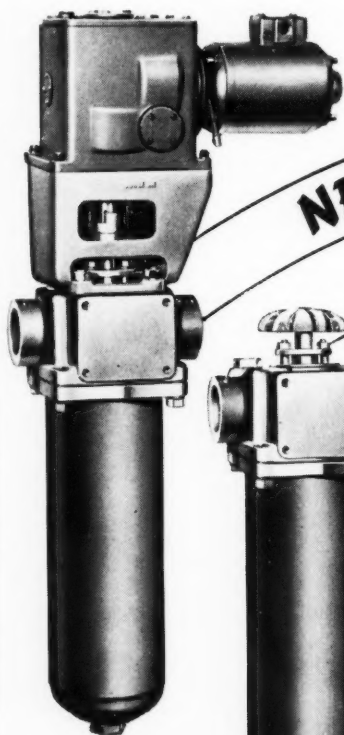
MODEL SG-4H



ABWOOD MACHINE TOOLS LTD., PRINCES ROAD, DARTFORD, KENT

SG4

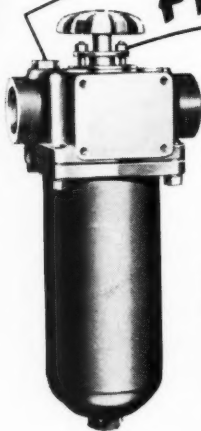
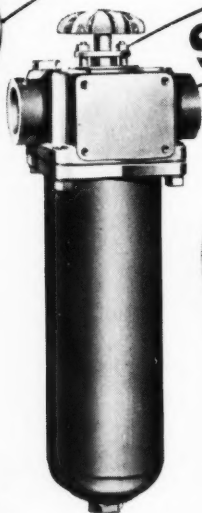
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NEW RANGE OF

SELF CLEANING

FILTERS



SIZES
FROM
 $\frac{1}{2}$ " to 2"
B.S.P.



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PUROLATOR

REGD. TRADE MARK

AUTOMOTIVE PRODUCTS COMPANY LIMITED · LEAMINGTON SPA · WARWICKSHIRE



Photo by courtesy of Fibres Division, Imperial Chemical Industries Ltd. Manufacturers of 'Terylene' polyester fibre.

C IS FOR CONVEYOR BELTS at a new I.C.I. plant in Cheshire, where eight Goodyear belts of rubber and 'Terylene' carry coke, burnt lime and coke/lime mixture. 'Terylene' was chosen for its flexibility and strength, which allows exceptionally deep troughing so that deck plates, skirt boards, etc., are eliminated and idlers can be spaced 50% wider apart. 'Terylene' also withstands the heat of the coke (carried at up to 120°C), is rotproof and resists moisture penetration. For the *right* conveyor belt, installed in the *right* way and maintained in the *right* manner, contact Goodyear Industrial Products Division at Wolverhampton.

GOODYEAR  **THE GREATEST NAME IN RUBBER**

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Products of a group founded over 40 years ago, ABMTM machine tools rate high in the estimation of industry. So much so that their accuracy, performance and general efficiency are often regarded as the required standards for machine tool manufacture. Such an index of quality is significant. It is brought about by skill and experience in the production of individual types of machines, as represented by six specialist but independent companies operating through a single organisation—ABMTM.

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No organisation or business whose need is for efficient machine tools of undoubted quality and durability can afford to disregard the assistance of such a unique service.



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for precision—power—dependability

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HALL No. 2

STAND No. 2110

7th EUROPEAN MACHINE-TOOL EXHIBITION



BRUSSELS 3-12 SEPT

B.S.A. TOOLS LTD
STAND 2110



machine tools, small tools, accessories, broaches, limit switches and, on adjoining stand No. 2007, The Churchill Machine Tool Co. Ltd. (B.S.A. Group), precision grinding machines.

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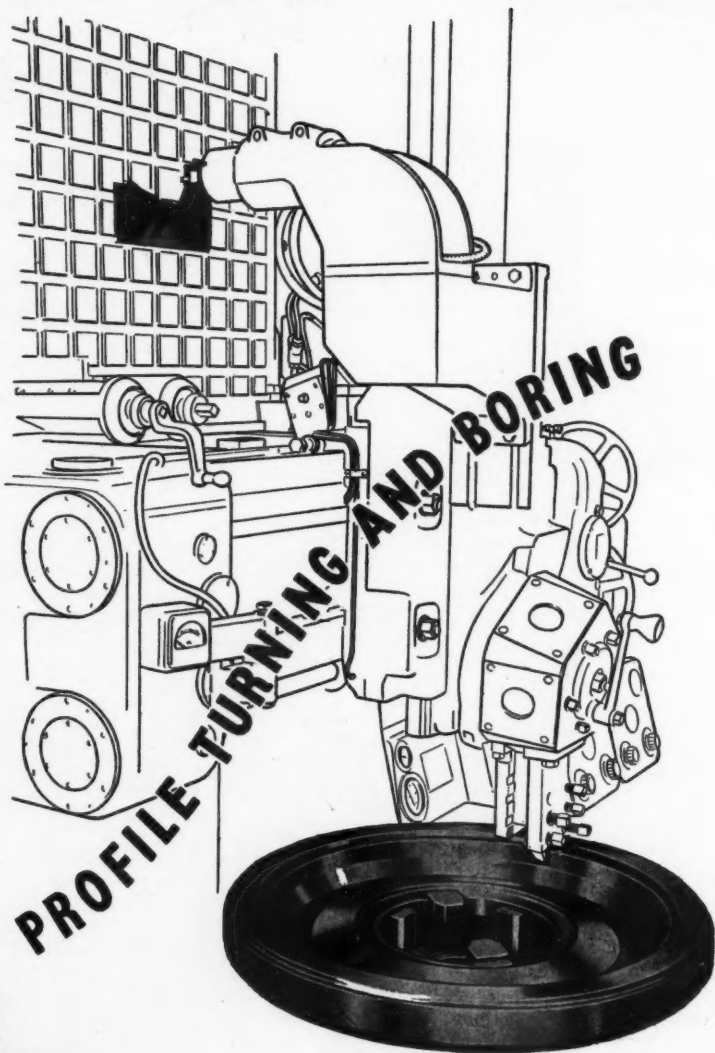
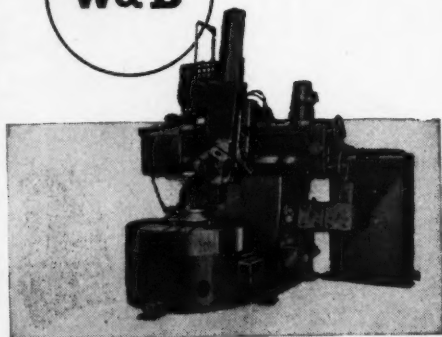
*For faithful
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of intricate
profiles*

automatically

*from simple
quickly produced
templates*

*and
reversion to
manual control
at will*

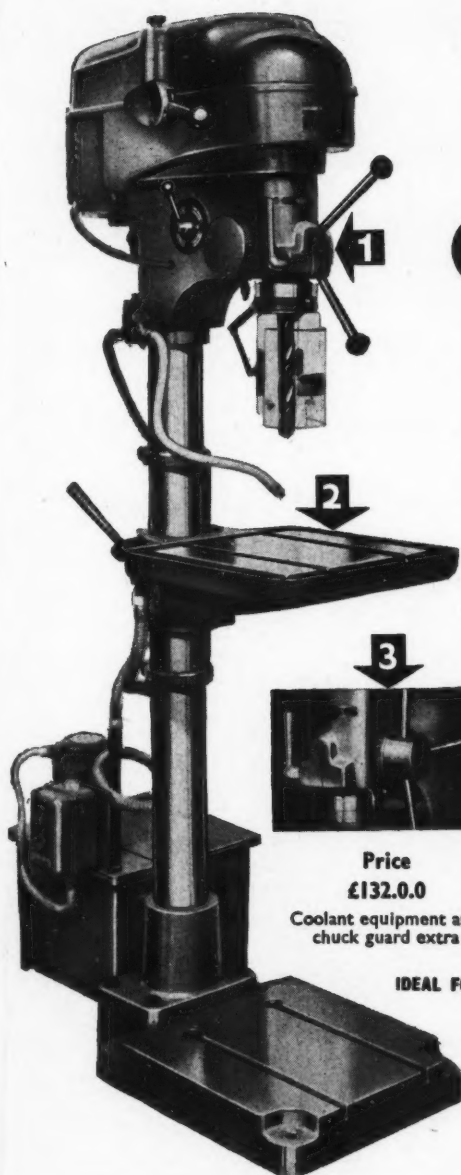
W&B



The application of electronic profile turning and boring equipment to the Webster and Bennett range of vertical boring mills opens up a wide new field of uses for these versatile machines. Although specifically designed for copying applications, when not required the electronic control may be disengaged and the machine operated as a standard machine under mechanical control. Machine capacities range from 36" to 72" chuck diameter, and machines can be supplied with or without the electronic profiling equipment.

WEBSTER & BENNETT LTD., COVENTRY, ENGLAND

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Price
£132.0.0

Coolant equipment and
chuck guard extra

IDEAL FOR MULTI-SPINDLE DRILLING TOO ➡

The MF5 Mk II is just the job for light multi-spindle work. Here you see it fitted with a universal type multi-spindle Head for drilling up to a maximum P.C.D. of 6".



*Here's precision plus—
at the right price!*

YOU'LL BE 100% SURE OF IT WITH A

MEDDINGS

Facera

MF5 Mk II DRILLING MACHINE 1" CAPACITY

MF5 Mk II—here's your codeword for accurate, economic drilling! Everything about this robust job adds up to just that! And what other machine offers such a specification at a comparable price?

Solid construction throughout means you've got real stability. The column is solid steel, 3½" diameter, and is ground all over. An oil immersed gearbox, totally enclosed in the Drill Head, gives eight spindle speeds (range 80-1,500 r.p.m.). Throat depth 9". Choice of High or Low speed setting for each of four Vee belt positions, thanks to accessible gear change lever with positive action.

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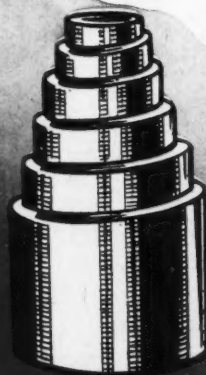
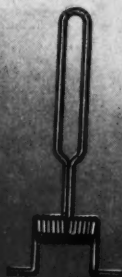
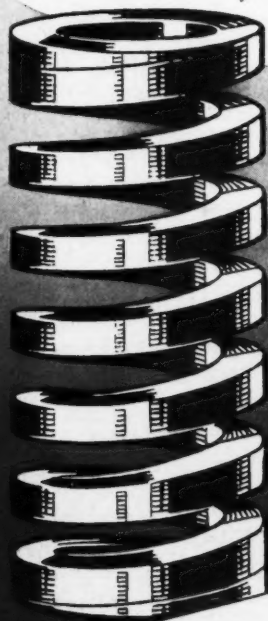
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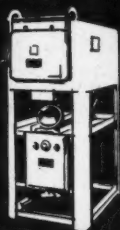
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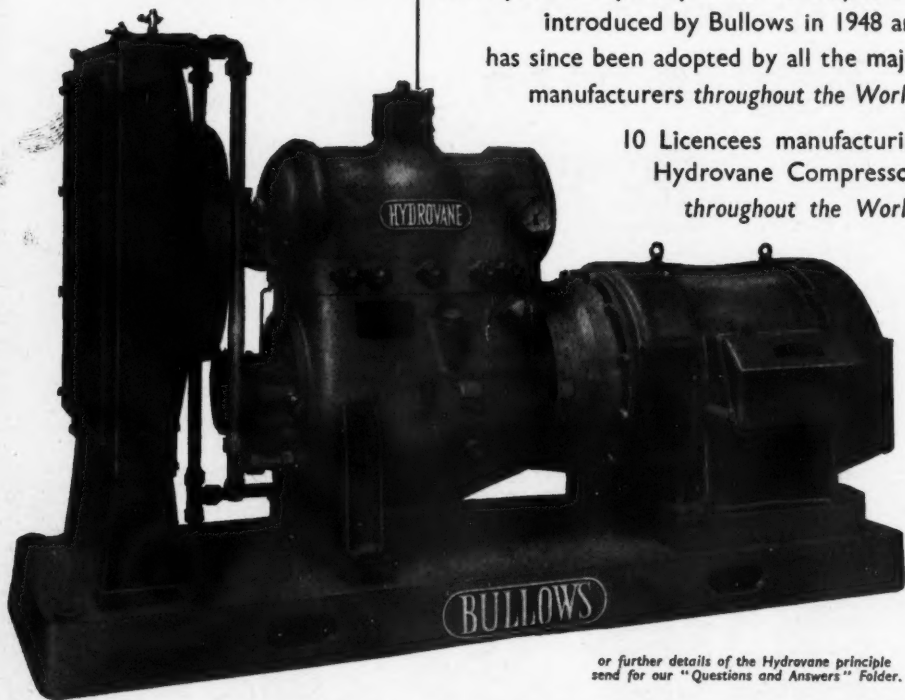
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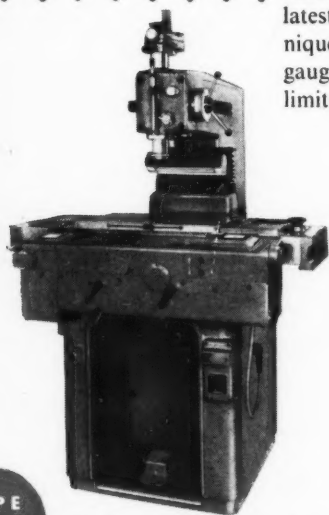
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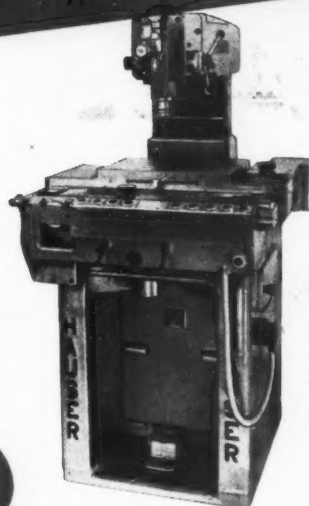
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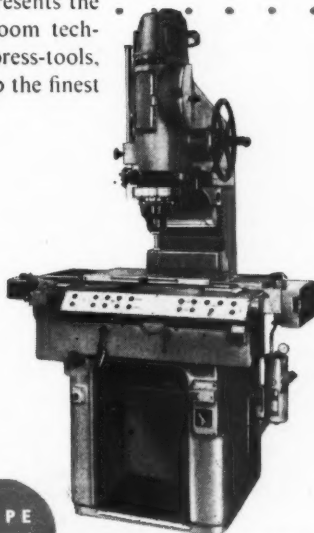


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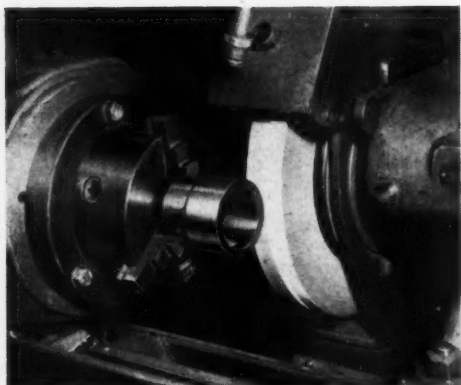
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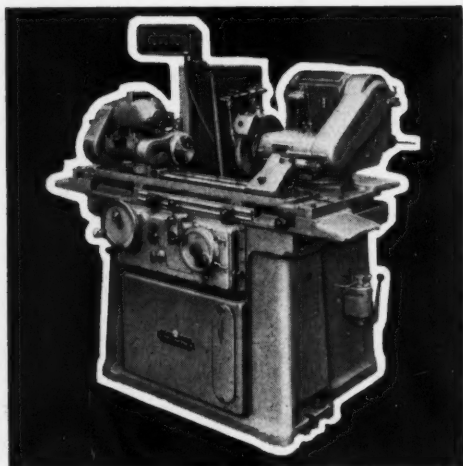
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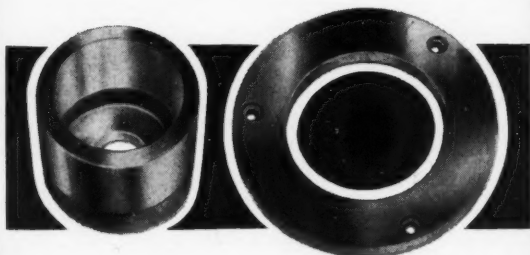
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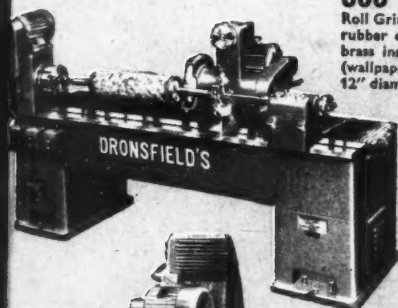
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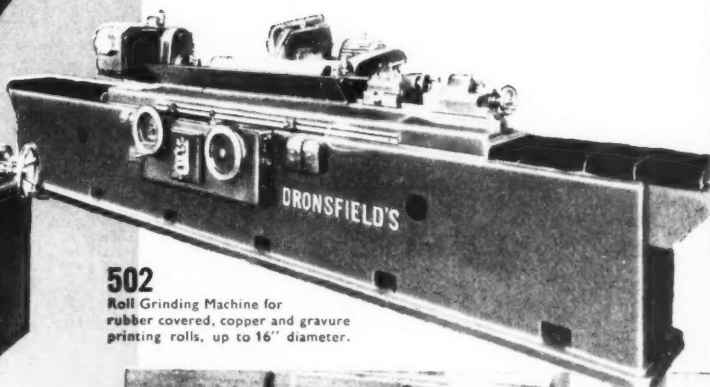
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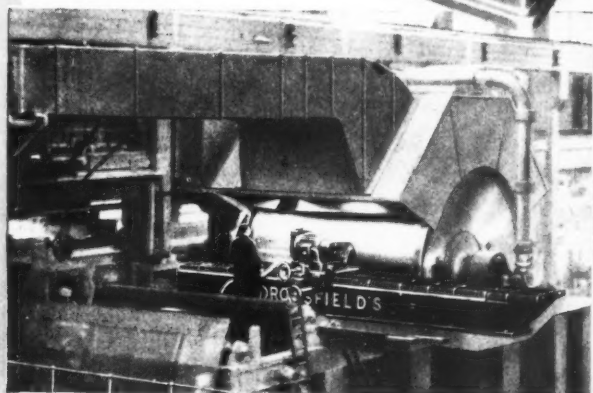
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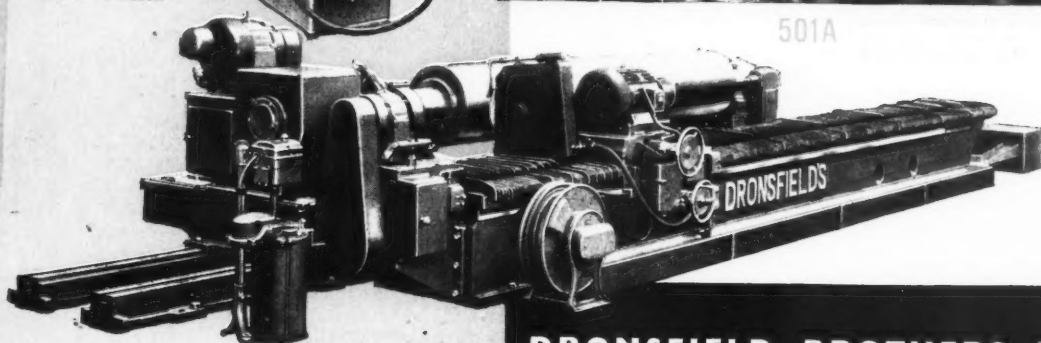


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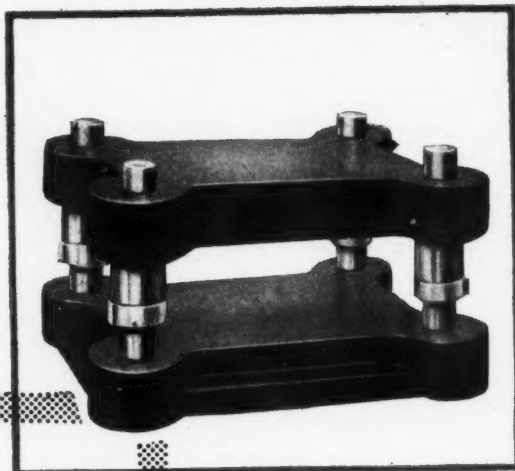
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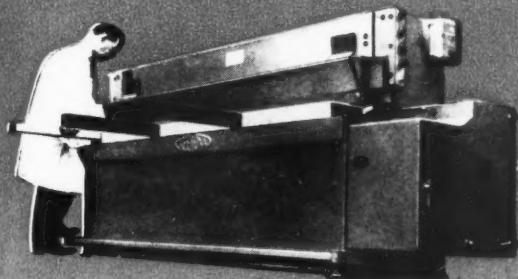
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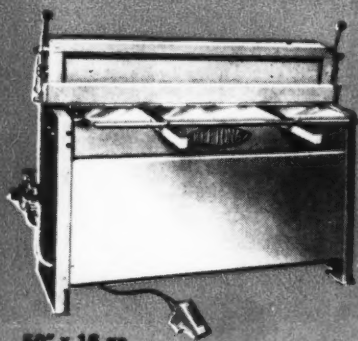


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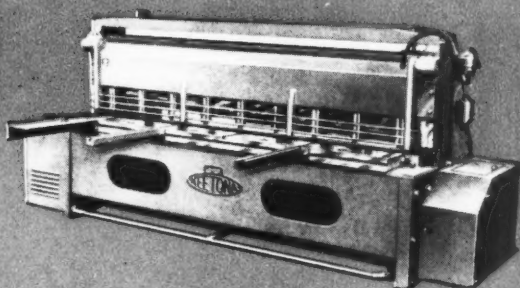
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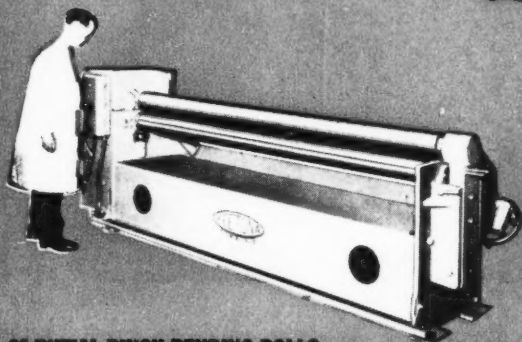
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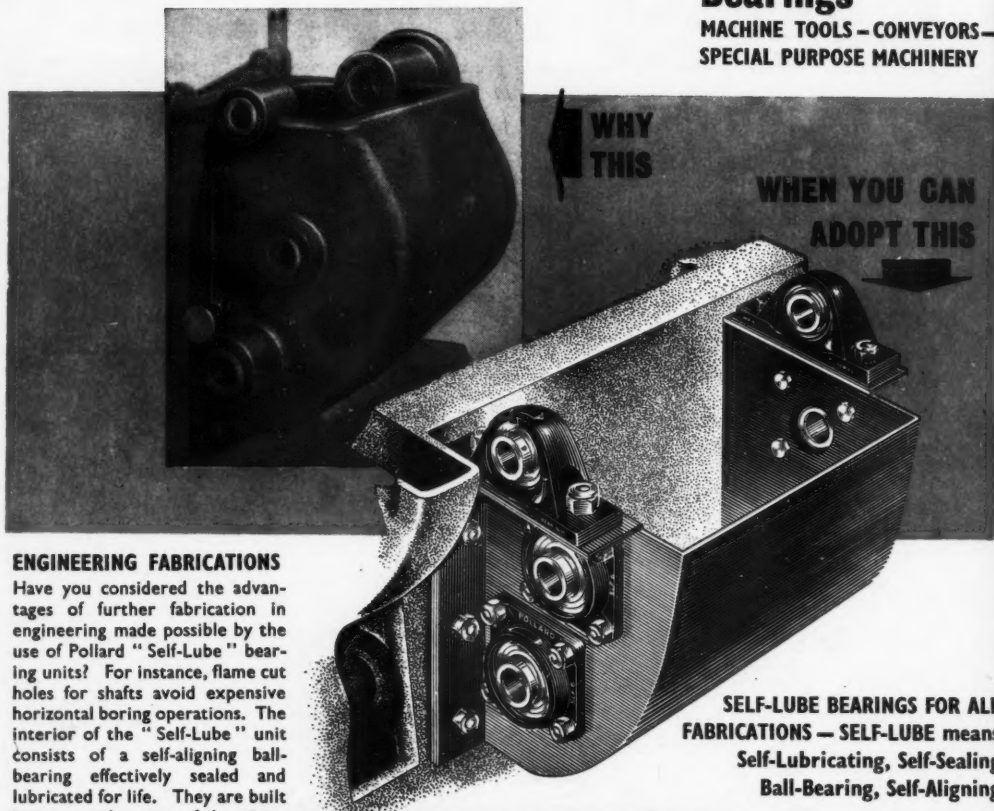
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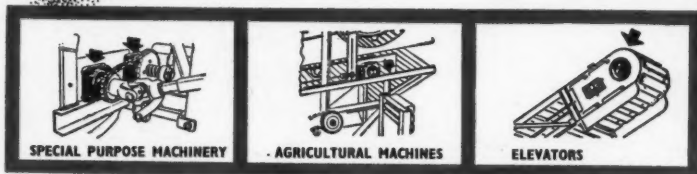


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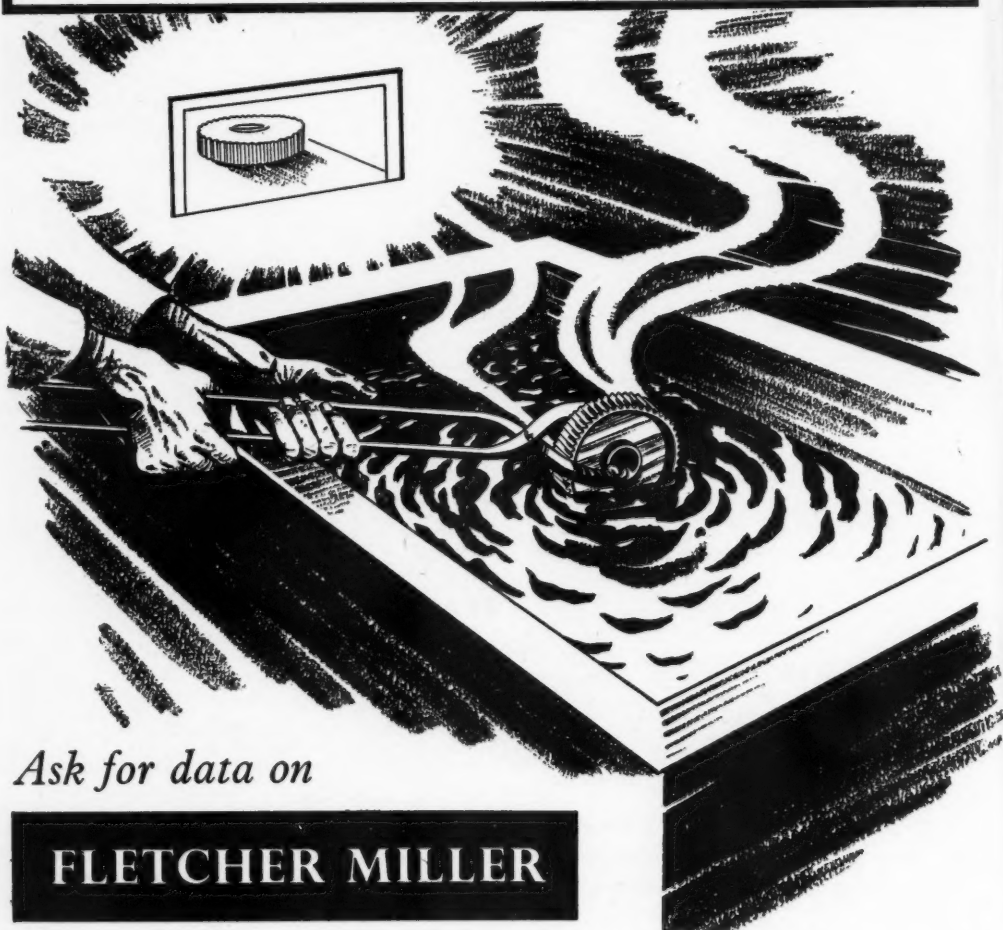
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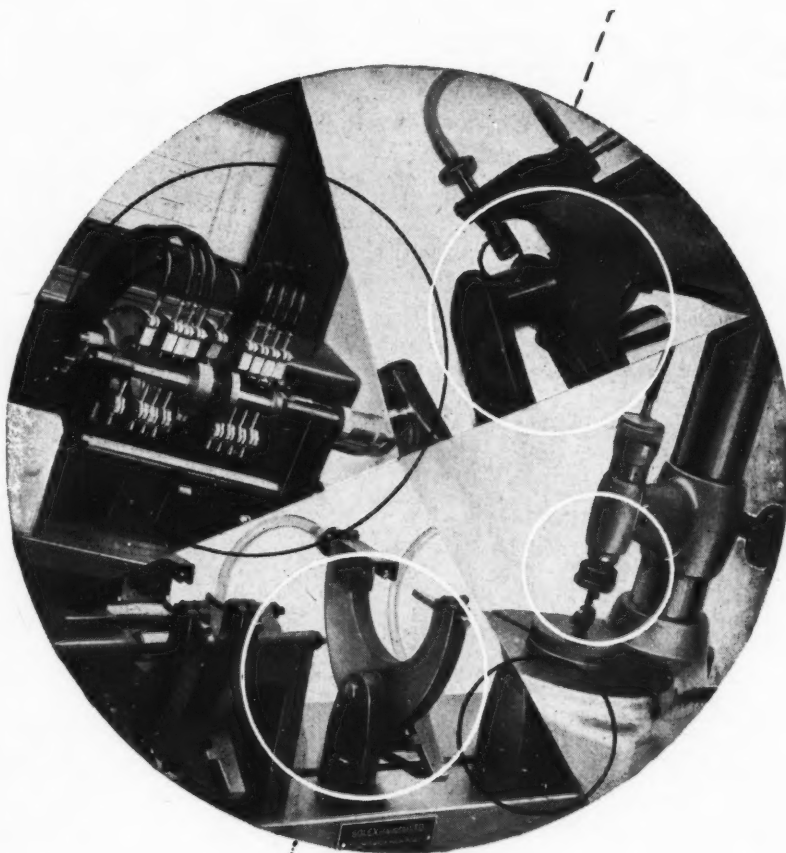
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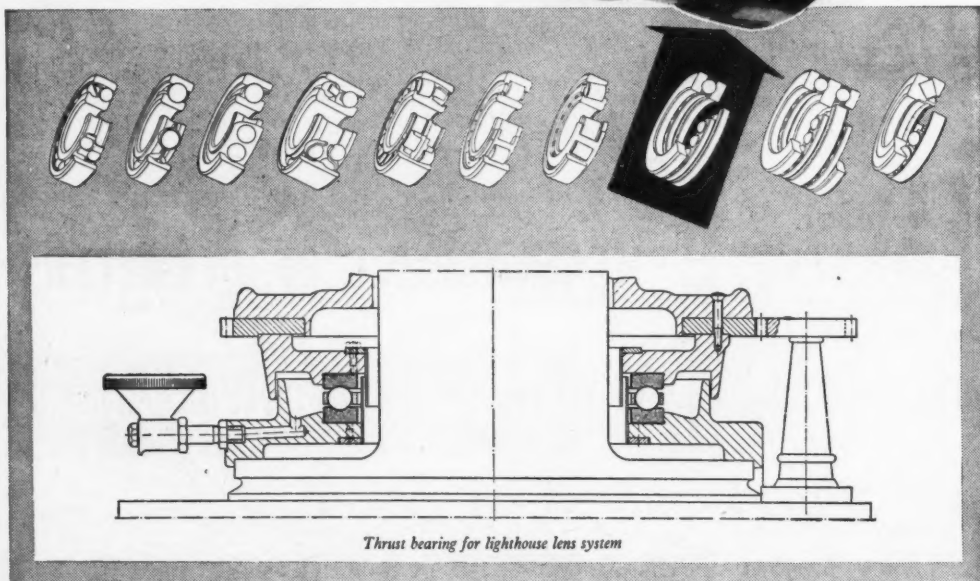
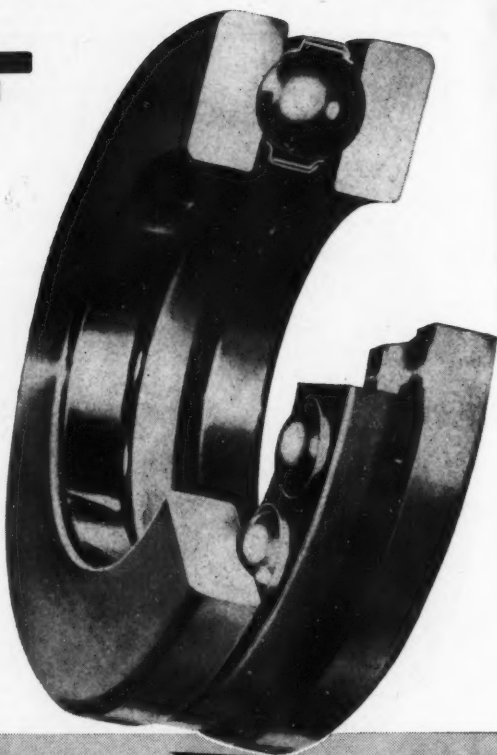
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Vol. 99, No. 2544

August 16, 1961



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Abstracts of Principal Articles

Producing Gas Turbine Components P. 348

The Aero-engine Division of Rolls-Royce, Ltd., located at Derby, is now concerned solely with the production of gas-turbine engines of various types. Avon gas turbines fitted to the Comet and Caravelle aircraft are provided with thrust reversers, and the main component, known as a thrust reverser box, is a weld-fabricated Nimonic assembly. Arcuate facings on this unit are milled on a Kendall & Gent machine, which has been adapted by Rolls-Royce, Ltd. Certain members of the welded assembly are machined from frames made by welding extruded Nimonic section. These frames are of arcuate form and are milled on a Cincinnati machine with hydraulic copy-control, which has been adapted by the company. The thrust reverser of the Conway engine incorporates a welded Nimonic assembly which forms a bellows seal, and has two elliptical flanges inclined relative to the main axis. The edges and lower faces of both flanges are machined at one set-up on a Webster & Bennett vertical turning and boring mill, equipped with an indexing fixture and a cam-operated profiling slide. Conway nozzle box outer casings are profile milled on a specially-built Cincinnati Hydrotel machine, with coupled rotating tables for the work and master. Hydraspeed heavy-duty serrated cutters are used for rough milling, and the machine has provision for varying the table speed to maintain a constant work feed rate. (MACHINERY, 99—16/8/61.)

Planning for the AEI Numeritrol Numerical Control System P. 359

This article is the second of two dealing with the AEI Numeritrol magnetic-tape numerical control system for machine tools, and describes the procedure for planning for a specific workpiece. The machine user compiles a planning sheet, and from this information produces a punched-paper tape, which is identified as Tape A. This tape is sent to the AEI Tape Service Centre at Leicester, where it is fed through a general-purpose computer which converts the dimensional data relating to the periphery of the workpiece into terms of the path to be followed by the centre of the cutter. The output from this computer is in the form of a second punched-paper tape (Tape B) and the latter is then fed to a special-purpose computer, known as the Director. This unit converts the incremental information into continuous data, and

records it directly on to a magnetic tape, which is subsequently used to control the machine tool. (MACHINERY, 99—16/8/61.)

The Activities of Paterex, Ltd. P. 366

Paterex, Ltd., who are concerned with the quantity production, on a contract basis, of a wide variety of components from steel bar, have recently occupied an entirely new factory which has a floor area of 35,000 sq. ft., at Cray Avenue, St. Mary Cray, Orpington, Kent. A total of 105 single-spindle automatics with bar capacities up to 1½ in., also capstan lathes, centreless grinders, thread rolling machines, a Cri-Dan automatic screwcutting lathe and a number of other machines, on which second operations are carried out on certain components, are installed. The company has built an automatic machine with a hopper feed unit for chamfering the bores of blanks for special nuts, also a multiple-barrel finishing machine, which enables a number of fairly large batches of small components to be handled simultaneously. (MACHINERY, 99—16/8/61.)

Slack & Parr Unit Head Machines P. 369

Unit head machines built by Slack & Parr, Ltd., Kegworth, near Derby, for performing such operations as drilling, tapping, countersinking, spot-facing, and in-line reaming, on pistons for disc brakes, bail components for domestic vacuum cleaners, acoustic-insulating boards, and frame components for dictating machines, are described in this article. On most machines, the air-hydraulic unit heads, which are of Slack & Parr design, are fitted with the company's gearless multi-spindle drilling attachments. In addition, details are given of set-ups on the firm's air-hydraulic bench-mounted drilling machines, fitted with multi-spindle attachments and special work-holding fixtures, for drilling ear and mouthpiece components for telephones, and small diameter spindle components for electric shavers, also for drilling and tapping cylinder heads for air compressors. (MACHINERY 99—16/8/61.)

IN FORTHCOMING ISSUES

Producing the Smiths automatic transmission—Numerical control applied to Pratt & Whitney machines for inspection.

Contributions to MACHINERY

If you know of a more efficient way of designing a tool, gauge, fixture, or mechanism, machining or forming a metal component, heat treating, plating or enamelling, handling parts or material, building up an assembly, utilizing supplies, or laying out or organizing a department or a factory, send it to the Editor. Short comments upon published articles and letters on subjects concerning the metal-working industries are particularly welcome. Payment will be made for exclusive contributions.

EDITORIAL

The Attitude of Small and Medium-sized Firms to Export Trade

In a recent issue of MACHINERY attention was drawn to the growing importance of the contributions which are made by the various branches of the metal working industries to the total export trade of the country, and it was suggested that if the recent rate of expansion of exports of metals and metal products could be sustained, a more satisfactory overall growth in the value and volume of goods consigned overseas might be anticipated in the future. It is evident, however, that if this continued expansion is to be achieved an intensification of efforts will be necessary on the part of the companies which make up these branches of industry, and it is obviously desirable that these efforts should be as widespread as possible. As is well known, firms of small and medium size play a very important part in the metal working industries, as in other fields of manufacture in this country, and it is most desirable, therefore, that these smaller engineering companies should, as far as possible, participate in export trade, at least in proportion to their scales of operation.

Although there does not appear to be any definite evidence on this point, it seems reasonable to assume that it is among these smaller firms, collectively, that the greatest scope for expansion of export trade exists. Acting on this assumption, the Export Action Now Committee of the Institute of Directors has sponsored a pilot survey* which was designed to shed some light on the attitudes of typical firms in this category towards exporting, and the reasons for those attitudes. The survey covered 52 firms which were classified as medium (100 to 300 employees), small (40 to 99 employees), and very small (less than 40 employees), and of the total, 26 were concerned with engineering products and 26 with consumer goods. As the number of companies involved was necessarily so restricted, it would obviously be unwise to draw any very general conclusions from the results. Nevertheless, they undoubtedly afford some useful guidance as regards the situation prevailing, and it may be noted that of the 26 firms making engineering products 10 (6 medium, 2 small, and 2 very small) were exporting more than 10 per cent of output, 6 (2 medium, 3 small, and 1 very small) were exporting 10 per cent or less, and 10 (5 small and 5 very

small) were not carrying on any export trade at all.

The firms which co-operated in the survey were also grouped in accordance with "export behaviour," and it was found that of those engaged in engineering, 27 per cent were exporting fairly vigorously, 38 per cent reported that exports were declining or were static at a fairly low level, 8 per cent were non-exporters and although desirous of entering the export field were uncertain as to what action to take, and 23 per cent did not export, had never exported, and showed no real interest.

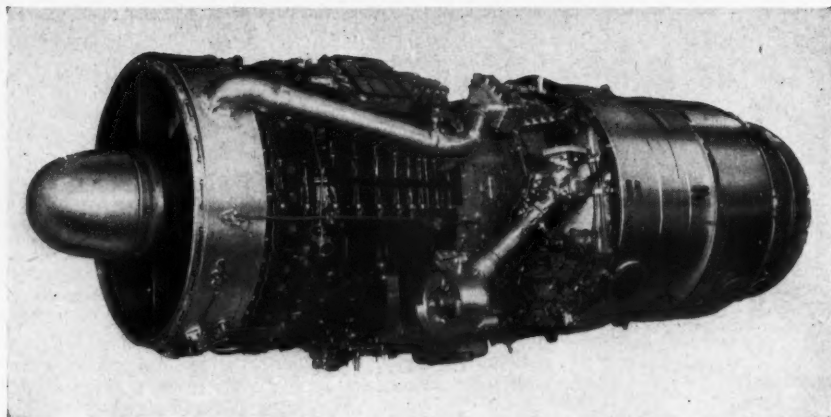
How are these differences to be explained? After making due allowance for the "modest and restricted" scale of the study, those responsible suggest that: "In the overwhelming majority of cases, the failure of the British manufacturer to increase or even maintain his exports, or to get into the export market at all, is a function not of any external circumstances but of his general attitude towards exports."

It was noted in this connection that of the firms which were exporting vigorously and had volumes of exports that were increasing or were being maintained at a high level, "practically every one was highly active in marketing, sales promotion, and selling, or in investigating and developing new markets, or in the development of new or modified products suitable for export markets." On the other hand, among those firms which had volumes of exports that were declining, or static at low levels, or had abandoned exporting altogether, "very few indeed had attempted to do anything serious about it."

There are, it is pointed out, a wide variety of different reasons why a particular manufacturer may not be particularly anxious to devote much attention to exports. Such an attitude may be based, for instance, on the results of serious assessments as to the relative profitability of expansion in the home as against the export markets, or "a complete lack of interest in anything which might be troublesome or involve more work." Other reasons include a lack of confidence on the part of the individual in his own abilities or those of his associates, "fear of the unknown, distrust of foreigners, and a feeling of inadequacy, linked with all these (reasons) and with a lack of understanding of what

(Continued on page 389)

* This survey was conducted by Marplan, Ltd.



Producing Gas Turbine Components

Examples of the Methods and Equipment Employed by Rolls-Royce, Ltd., Derby

By P. A. SIDDER?, Chief Associate Editor

THE INTRODUCTION OF THE GAS TURBINE brought about radical changes in the machining techniques and equipment employed for the production of components for aircraft engines. Operations on parts for piston engines were generally similar to those employed in the motor car industry, although the techniques were more refined to permit the maintenance of closer dimensional tolerances and higher standards of surface finish. The production of gas turbines has necessitated the development of new methods, notably for the machining and finishing of the large numbers of blades required, and the latest practices in this field have been described from time to time in MACHINERY. It has also been necessary to develop methods for machining some of the larger components of gas turbines, such as casings and rings, and fresh problems have arisen as the size of these power units has increased and castings have been replaced by weld-fabricated components in the newer heat and corrosion resistant alloys.

Rolls-Royce, Ltd., have always been in the forefront of aero-engine development, regardless of whether such engines have been of piston or turbine type. In the gas turbine field, the company made preliminary studies in 1938, and later collaborated with Sir Frank Whittle on research and development. During recent years there has

been steady improvement in the power outputs of successive types of Rolls-Royce gas turbines which have been introduced, as a result of important advances in design, for example, in connection with units of the by-pass type.

A typical gas-turbine unit in current production is the civil version of the Avon turbo-jet, seen in the heading illustration, the design of which incorporates much of the experience gained as a result of extensive operation of the military versions. Developed to achieve lower fuel consumption and long life between overhauls, the civil Avon has a thrust range of 10,250 to 12,725 lb. For comparison, the military version, which went into service in 1951, has been developed to give a thrust of 13,220 lb.—more than twice the output of early engines of this type—and with re-heat, this figure is increased to more than 16,000 lb.

The civil Avon was put into operation in 1958, in a de Havilland Comet 4, for the first jet passenger service across the North Atlantic. It was then the first engine to go into service with a life between overhauls exceeding 1,000 hours. Shortly afterwards, the Avon was used to power the French Sud-Aviation Caravelle aircraft. The overhaul life of the civil Avon is now 2,900 hours, and at modern speeds, this life represents more than a million flight miles between overhauls.

Only gas-turbine engines are built by the Aero Engine Division of Rolls-Royce, Ltd., which is located at Derby. Light piston engines for aircraft are to be made, however, under licence from the Continental Motors Corporation, U.S.A., at the works of the Rolls-Royce Motor Car Division, Crewe. Some of the machining set-ups and equipment that have been developed by the company for the production of components for gas-turbine engines are here described.

MILLING FACINGS ON THE AVON THRUST REVERSER BOX

It is now becoming customary to fit gas turbine engines with auxiliary units, known as thrust reversers, whereby the direction of flow of the hot gas stream, issuing from the jet pipe, can be diverted to slow down the aircraft on landing. This equipment is mounted at the tail end of the engine, and the thrust reverser assembly for the Avon engine is shown in Fig. 1. The left-hand end is coupled to the main engine casting, and at the upper left may be seen an outlet duct fitted with guide vanes to direct the flow of the jet stream. This duct is one of two, which are mounted on either side of a unit known as a thrust reverser box, wherein are housed pivoted shutters to close

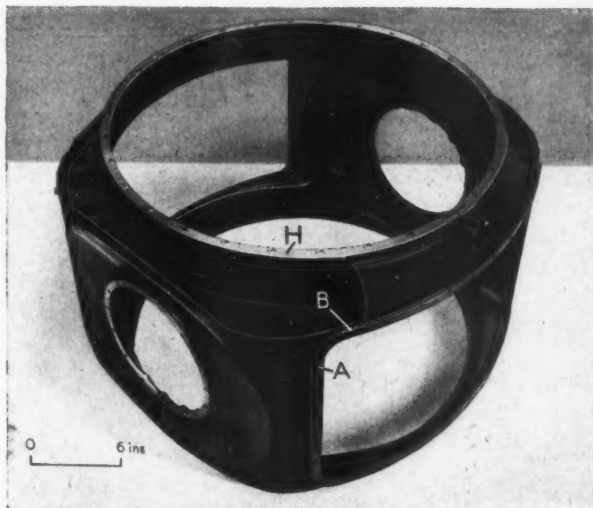


Fig. 2. A Nimonic welded assembly which forms the thrust reverser box for the Rolls-Royce Avon gas turbine engine is here seen in the partly machined condition

the main gas efflux passage at the right, and deflect the gas stream outwards.

An Avon thrust reverser box, seen in a semi-finished condition in Fig. 2, is a large welded assembly, made from Nimonic 80, with opposed arcuate facings, as at A. These facings provide for mounting the outlet ducts, and each facing is of part-cylindrical form, with the axis of the cylinder displaced from the axis of the box. It is necessary to machine each facing to provide a good seating for the associated component, and a shallow clearance channel, as at B, is also milled along one edge.

The facings are slab-milled on a specially-adapted Kendall & Gent openside machine, and a general view of the set-up is given in Fig. 3. A vertical pillar C has been fitted to the machine by Rolls-Royce, Ltd., and has guideways which

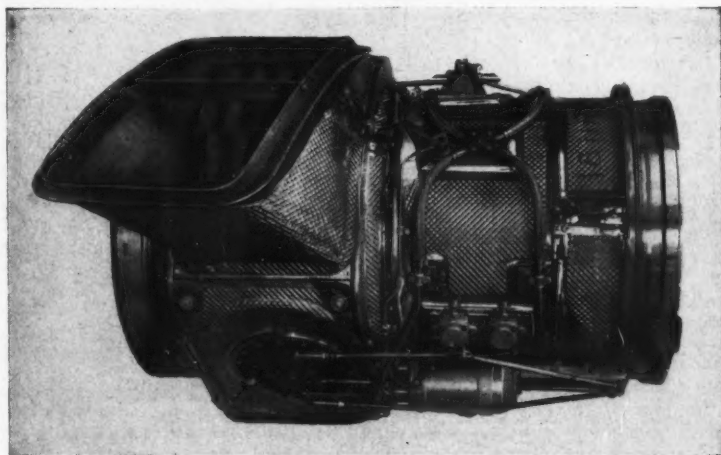


Fig. 1. General view of the thrust reverser assembly fitted to the civil version of the Rolls-Royce Avon gas turbine



Fig. 3. General view of the set-up on a Kendall & Gent milling machine for operations on the large rectangular facings on the thrust reverser box for the Rolls-Royce Avon gas turbine engine

carry an adjustable bracket *D*, with a bearing to support the lower end of the cutter arbor. This bracket is bolted to a heavy plate *E*, which is secured by screws and dowels to facings machined on the under-side of the milling head by Rolls-Royce. As may be seen, the Kendall & Gent machine is fitted with a power-driven rotary table, and the cover for the feed box of this unit has been replaced by a piece of thick steel plate *F*, which is ground on both faces. This plate remains permanently on the machine, and a block *G* is clamped to the top face to support the lower end of the pillar *C*. At the lower end, the pillar is machined flat and square with the guideways, and it is secured to the block *G* by screws that pass through slots in the bottom flange.

Fig. 4 is a close-up view of the workpiece and cutter gang, and the support bracket for the lower end of the arbor is again indicated at *D*. The support bearing has flanges which engage the upper and lower faces of the bracket, and the bearing is held in place by a swinging clamp, secured by an eye-bolt and nut. Four interlocking slab mills, of 4½ in. diameter, are mounted on the arbor to form an assembly with an overall length of 15 in. Each cutter has 16 teeth, of

30 deg. helix angle, and the cutters are alternately of right- and left-hand helix. A 5¼-in. diameter side-and-face cutter is mounted on the arbor above the slab-mills and provides for milling the clearance channel (*B*, Fig. 2).

The sequence of milling operations provides for three roughing cuts, one finishing cut, and a channel milling stage on each facing, and the time required for setting and machining each facing is 4 hours. A cutter speed of 20 r.p.m. is employed, and for the roughing stages, the rotary table is driven to provide a feed rate of 0.25 in. per min. (on a 20-in. diameter) for milling the vertical end portions of the flange, and a feed rate of 0.6 in. per min. for the horizontal portions. For finishing, a constant feed rate of 0.25 in. per min. is employed. In-feed is applied by releasing the clamps for the support pillar

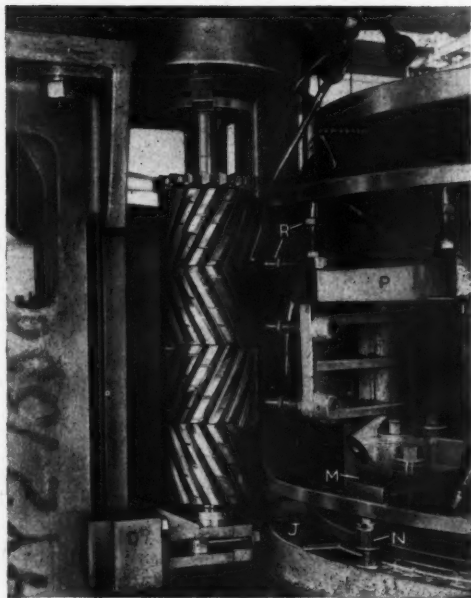


Fig. 4. Close-up view of the cutters for milling the facings on the Avon thrust reverser box. A steady bracket to support the end of the cutter arbor has been added to the machine by Rolls-Royce, Ltd.

and advancing the table of the machine towards the cutters, after which the pillar is re-clamped. The specified increments of in-feed are 0.050 in. at each roughing stage, and 0.005 in. at the finishing stage. In Fig. 3, the workpiece is seen after the first roughing stage has been completed. It may be pointed out that the total allowance of metal to be removed during rough milling of the flanges is not 0.150 in. Provision is made for three increments of 0.050 in., however, to allow for any slight misalignment during the welding of the metal frame (that forms the facing) to the body of the component.



Fig. 5. A machined Nimonic frame ready for welding to the main body of the Avon thrust reverser box is here seen on the table of the Cincinnati machine employed for milling the arcuate inner surface

FIXTURE DESIGN

It will be appreciated, from a study of Fig. 2, that the component must be very carefully supported and clamped, in order to avoid distortion of the machined faces. At the lower end there is a machined flange, similar to that seen at *H* in Fig. 2, and the component is loaded so that the lower flange bears on a seating face on the upper member of the fixture base. Four hardened steel sector plates, as at *J* in Fig. 4, are screwed and dowelled to the seating face, and engage the periphery of the lower flange to locate the component on the fixture. The upper member is arranged to swing about a pivot that is eccentric to the common axis of the lower member of the fixture base and the rotary table of the machine. The arrangement is such that the upper member, and with it the work, can be indexed through 180 deg., to enable both facings on the component to be milled at the same set-up.

The component is secured by three sets of clamps, and these clamps include a large disc, seen at *K* in Fig. 3, which bears on the upper flange of the workpiece, and is thrust downwards by a nut and C-washer on a pillar that extends upwards from the fixture base, through the component. There are swan-neck clamps, as at *L*, which engage the lower flange of the workpiece, and pairs of strap clamps, as at *M* in Fig. 4, ex-

tend outwards from the interior of the component and bear on the metal behind the flanges. The latter clamps are positioned immediately over jack-screws, as at *N*, fitted to the fixture base upper member to support the component from below.

Mounted on the upper member of the fixture base there are castings over which the component is loaded. These castings are fitted with adjustable steady screws, set at suitable angles, which are advanced to contact the internal surfaces of the component, above and below the rectangular openings within the facings to be machined. The screws support the component against the thrust of the milling cutters. Each casting has a pair of pillars whereon can be mounted a cast bracket member, as at *P* in Fig. 3 and 4, which is introduced through the rectangular opening in the component. This bracket member carries steady screws, as at *R*, which bear against the inside of the welded-on frame, to provide further support. It may be observed that the screws only support the upper long side of the frame and the short side that is leading as the component is rotated for cutting, the trailing short side being unsupported.

As has already been mentioned, the facings are machined on frames which are welded to the main body of the thrust reverser box, and one such

frame is seen in the foreground in Fig. 5. Each frame is made from extruded Nimonic material, which is bent and welded to produce a plan-shape that is rectangular with rounded corners, and then formed to the required arcuate shape in elevation. The finish-machined frame is seen in Fig. 5 on the table of a Cincinnati Hydromatic horizontal bed-type milling machine, which is employed for the first operation in the machining sequence. At this stage, the inside face of the frame is profile milled to an arcuate shape, and the Cincinnati machine has been specially adapted to ensure maximum rigidity by Rolls-Royce, Ltd.

A massively-proportioned overarm has been fitted to the cutter head of the machine, which can move on vertical guideways of the column on one side of the bed. The overarm is indicated at S, and the end remote from the cutter head can slide in vertical rectangular-section guideways on a rigidly constructed outboard support bracket, which has been fitted to the bed of the machine by the company. This bracket is just visible at T. The machine has a hydro-copying valve U on the cutter head, and is fitted with a disc-type follower V, the diameter of which corresponds to that of the milling cutters employed. This follower engages the upper, profiled, edge of a template W, mounted on the table. The arrangements are such

that as the machine table is traversed from right to left (as viewed from the front of the machine) the cutter head and overarm are moved to machine the inner face of the work to the required form.

A gang of five interlocking slab mills is employed, and the cutters are of $4\frac{1}{2}$ in. diameter, with teeth of 15 deg. helix angle, and arranged in in the gang with teeth of right- and left-hand helix alternately. The cutters are run at 24 r.p.m., and the table is advanced at a cutting feed rate of 1 in. per min. During the milling operation, soluble oil coolant is supplied from the pipe X. The minimum amount of metal is removed from the welded frame to clean up the inner face, and the total depth of cut is usually about 0.050 in.

MILLING FIXTURE DESIGN

The fixture employed to hold the frame during the profile milling operation, seen in the background in Fig. 5, is shown in Fig. 6 with the work removed. A heavy-section cast-iron base is machined to provide an arcuate seating face Y, whereon the outer surface of the component rests. At one end of the base there is a machined slot to receive hardened steel blocks, as at Z, which are screwed and dowelled in position. A screw (not visible in the illustration) at the opposite end of the fixture is employed to thrust the component into contact with the blocks, for end-wise location.

Along the front of the fixture base there are five edge clamps, as at A, which are disposed at angles such that they are nominally tangential to the arcuate seating face. Each edge clamp can be adjusted radially by means of a screw, as at B, and it has two slots through which clamping studs pass. The edge clamps thrust the component transversely into contact with two fixed location pegs, one of which is seen at C. Between these pegs there are three adjustable steady screws, carried on pillars, and a row of five similar screws is provided at each side of the

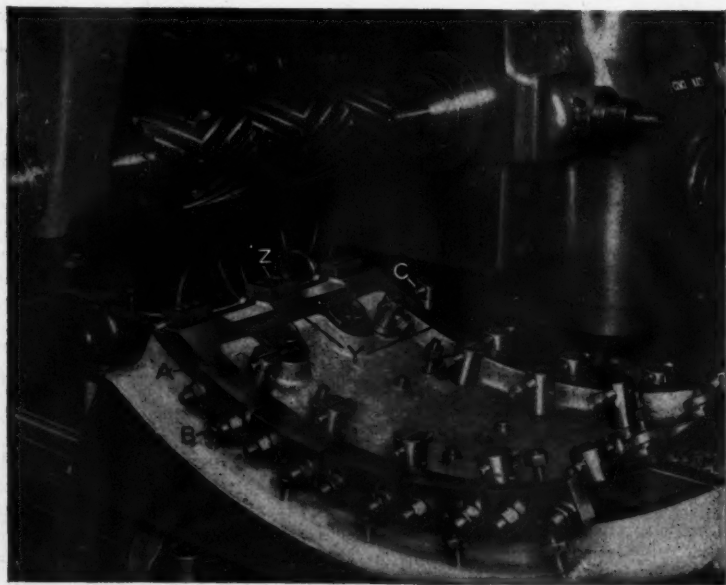


Fig. 6. The fixture for holding the Nimonic frame during profile milling on the Cincinnati machine, which has been adapted by Rolls-Royce, Ltd.

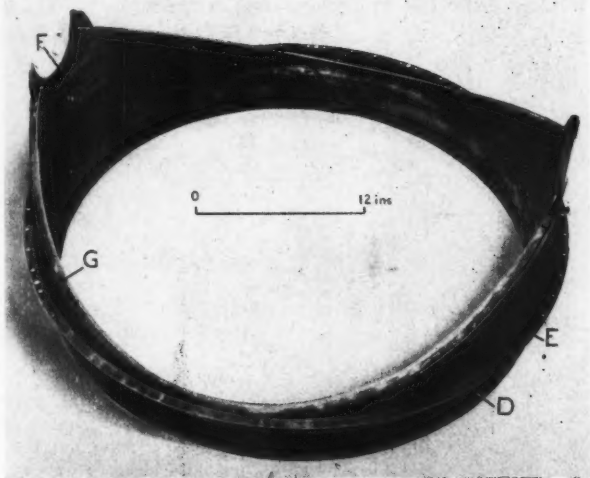


Fig. 7. A semi-finished rear seal for the thrust reverser fitted to the Rolls-Royce Conway by-pass gas turbine engine. The inclined elliptical flanges of this component are machined on the edge and lower surface

fixture base, within the work-seating. All these screws are advanced to contact the work and to steady it during cutting.

Following the profile milling of the inside face of the frame, the component is subjected to a series of other operations which include straddle milling the sides, profile milling the internal form, and machining the outer face on a vertical turning mill.

MACHINING THRUST REVERSER REAR SEAL

Fig. 7 shows a weld-fabricated Nimonic component known as a thrust reverser rear seal, for the Conway by-pass gas-turbine, of 17,500 lb. thrust. This component fits inside the thrust reverser box, and serves to connect it to the main jet outlet pipe. Corrugated cylindrical bellows, as indicated at *D*, are incorporated to allow for expansion, and the component is secured to the thrust reverser box by bolts which pass through the flange *E*. There is a similar mating component, known as a front seal, which fits in the thrust reverser box and connects with the outlet end of the engine. The principal difference between the front and the rear seals is that the former does not incorporate bellows. When the two components are assembled to the box, semi-circular seatings in each, as indicated at *F*, form housings for bearings that support swinging door assem-

blies, arranged one on each side of the thrust reverser unit. When the thrust reverser is brought into operation, these doors are swung inwards to close the main jet outlet pipe, and the flow of hot gases from the engine is then diverted through openings at opposite sides of the thrust reverser box, and thence through guide vanes that impart the required direction to the flow.

It will be observed that there are two inclined flanges, as at *G*, and the lower faces of these flanges must be machined to provide a seal, the included angle between them being held to 116 deg. 30 min. Moreover, the edges of the flanges must be machined for clearance purposes. Machining of the flanges is performed on a Webster & Bennett 5-ft. vertical turning and boring mill, which was built specially for Rolls-Royce with an extra high column to give greater clearance than normal between the table and the cross-rail. This machine is equipped with a fixture which is



Fig. 8. Setting up a Conway thrust reverser rear seal in preparation for machining the flanges on a Webster & Bennett vertical turning and boring mill, at the Rolls-Royce Derby works



Fig. 9. General view of the indexing fixture and cam-operated profiling unit built by Rolls-Royce, Ltd., for machining the flanges of thrust reverser seals

designed to secure and locate the rear seal under conditions similar to those prevailing in service. Each flange is machined in turn, with the component arranged so that the flange is horizontal. It will be appreciated that, since the body of the component is circular, the flange is of elliptical shape, and the turret of the Webster & Bennett machine is fitted with a special profiling slide, which was designed and built by Rolls-Royce, Ltd.

FIXTURE DESIGN

The fixture used on the vertical turning and boring mill is seen in Fig. 8, and the workpiece is indicated at *H*. Of angle-plate type, the fixture is mounted on the rotating table of the machine, and has a heavy cast base *J*, with a bearing surface machined at an angle of 31 deg. 45 min. to the seating face. This angle is equal to 90 deg. minus half of the included angle between the flange faces of the component. On the bearing surface is mounted a platen *K* which can be rotated, and located in two positions, 180 deg. apart, by an index plunger. After this plunger has been withdrawn by the associated lever *L*, the platen is turned with the aid of a tommy-bar inserted in holes spaced round the periphery.

More than one type of thrust reverser component

is machined in the fixture, and interchangeable work-support elements are secured to the platen. For the Conway rear seal, these elements take the form of a support ring *M* and brackets, as at *N*. The upper face of the ring *M* is machined to receive the main securing flange of the component, which is located by dowels. Projecting from the ring are eight brackets carrying simple strap clamps, one of which is indicated at *P*, and these clamps bear on steel half-rings, as at *R*, which distribute the clamping pressure over the component flange.

At a previous operation stage, the bearing seatings (*F*, Fig. 7) at either side or the rear seal are machined on a Kearns horizontal boring machine. Trunnion blocks are fitted to the seatings when the component is loaded on to the Webster & Bennett machine, and each block has a main body of a diameter to fit the half-bearings at the upper ends of the brackets *N*, Fig. 8. On the inner end of each trunnion block there is a flange, as at *S*, and on the outer end there is an extension which is threaded for part of its length.

Each trunnion block is secured to the component by a clamp plate *T*, with an integral stud that passes through the block and is fitted with a nut and washer, which bear on the extension. A central recess and intersecting slot is machined in the clamp plate to provide clearance for the cutting tool in the profiling unit fitted to the machine turret. The trunnion blocks engage the half-bearings of the two brackets of the fixture, and are retained by hinged bearing caps, as at *U*, which are secured by eye-bolts and nuts. A collar *V* is provided on each trunnion block extension, and when the associated castellated ring-nut *W* is tightened on the thread at the end of the extension, the trunnion-block flange and the collar are closed on to the side faces of the half-bearing and cap, to secure the block axially.

Fig. 9 shows the fixture from the front, with the profiling unit in the operating position. Movement is imparted to the cutting tool *X* by a cam *Y*, fitted on a pillar that projects from the fixture base, so that the upper surface is horizontal. Surrounding the cam support pillar there are six smaller pillars, as at *Z*, which provide for mounting a setting plate, indicated at *A* in Fig. 8. The lower surface of an extension of the plate is finished to a specific distance from the seating face, and when the plate is mounted on a pillar, as shown, the

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lower surface of the extension serves as a datum for machining the seal face of the associated flange on the workpiece. When the workpiece has been loaded and clamped, the machine operator places a parallel bar on the horizontal upper face of the cam, as seen at *B*. This bar serves to support a scribing block fitted with a dial indicator gauge, which is set to zero with the stylus point in contact with the datum face on the setting plate. The scribing block is then moved on the supporting bar to bring the stylus point into contact with the unmachined seal face of the flange, and the dial indicator gauge is read to determine the amount of metal to be removed—usually 0.010 to 0.030 in.

Machining of the flanges is performed in two stages, and for the roughing stage, the platen *K* is secured by clamps at each side, one of which is indicated at *C* in Fig. 9. After both flanges have been rough machined, the component is removed from the fixture, and is checked by the inspection department. It is then returned to the fixture, and reset for the removal of the required thickness of metal from each flange, as determined by the checking operation.

PROFILING UNIT

The profiling tool *X*, Fig. 9, is tipped with Wimet grade N carbide, and is used for machining both the lower face and inner edge of each flange. This tool is mounted in a holder *D* that is integral with a horizontal cylindrical ram, free to slide in the housing *E*. A keyway is cut in the bore of the housing, and is engaged by a key fitted to the ram to prevent the latter from turning. Rack teeth are cut in the ram and mesh with a pinion at the lower end of an inclined shaft. Drive is transmitted to the shaft from the hand wheel *F*, through bevel pinions, and the tool can thus be fed radially. The housing *E* moves on a dovetail guideway machined on the block *G*, secured to one face of the machine turret.

Above the tool ram,

the housing *E* is bored to form an air cylinder, which slides over a piston fixed to a bracket on one side of the block *G*. Air is delivered to one end of the cylinder during the machining operations so that the housing is urged to the left (as viewed in Fig. 8) and a roller-bearing follower is held in contact with the periphery of the profiling cam *Y*.

In order to provide increased rigidity, hardened steel strips have been added to either side of the block, and are engaged by pairs of rollers carried on brackets attached to the housing *E*. The rollers are provided with adjustable eccentric mountings and are set to ensure that there is no play between the housing and the guideway.

For machining the flanges, the table of the Webster & Bennett machine is run at 11 r.p.m. The machine turret is fed vertically downwards, at a rate of 0.006 in. per rev., for turning the inner edge of each flange. For facing the lower surface of each flange, the tool is fed radially by hand, at a rate of approximately 0.005 in. per rev.

PROFILE MILLING THE CONWAY NOZZLE BOX OUTER CASING

An outer casing for the nozzle box fitted to the Conway engine is seen in Fig. 10. This component is a stainless steel casting, and it will be observed that it is machined all over to leave a

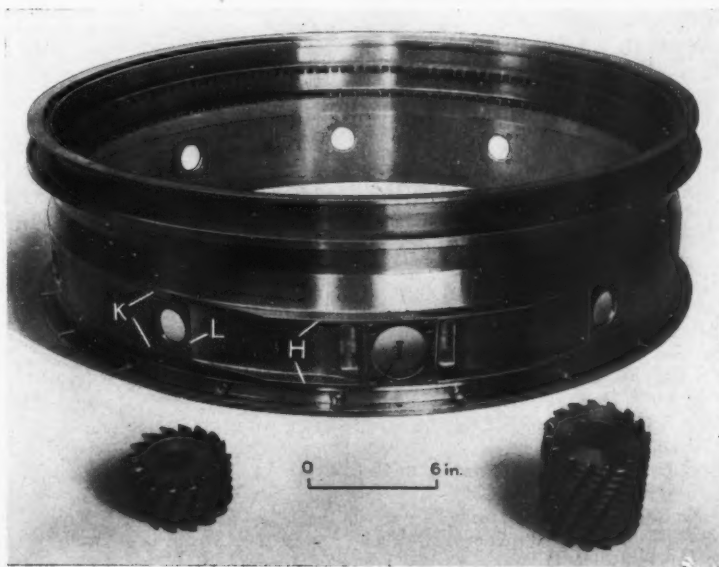


Fig. 10. A semi-finished nozzle box outer casing for a Conway gas turbine, with the Hydraspeed cutters employed for rough profiling operations



Fig. 11. Close-up view of the Hall & Pickles Hydraspeed heavy-duty milling cutter employed for the first roughing stage of the profile milling sequence on Conway nozzle boxes

thin shell, with various external and internal flanges, webs and pads. At one stage in the operation sequence, it is necessary to profile mill an annular portion on the exterior, to produce webs and pads, at positions 180 deg. apart, as indicated at *H* and *J*, respectively. Subsequently, pockets are milled at either side of each pad, as seen in the illustration, but the original profile-milled shape is clearly indicated on the lower webs.

Profile milling is performed in four stages, at one set-up, on a special Cincinnati Hydrotel machine. At the first stage, the full width of the annular portion is rough machined, using the Hall & Pickles Hydraspeed heavy-duty cutter seen at the right in Fig. 10. This cutter is of 5 in. diameter by 5 in. long, with 16 helical cutting edges, and has a continuous slow-helical groove, of knuckle form, in the periphery, so that each cutting edge is broken up into a series of teeth. Hydraspeed cutters were fully described in *MACHINERY*, 94/670—25/3/59, and the roughing cutter is seen in use in Fig. 11. High rates of metal removal are achieved due to the multiple single-point cutting action, and swarf clearance is facilitated because the chips produced are small. Conventional milling is used for this

roughing stage, with the cutter running at 24 r.p.m., and the work is rotated to provide a feed rate of 1½ in. per min. About 0.050 in. of metal (a side) is left on the work for removal at the finishing stage.

Following this stage, a second roughing operation is performed to remove the excess material between the webs *H*, Fig. 10, 0.050 in. (a side) being again left for finishing. The cutter for this stage is seen at the left in the illustration, and is of Hydraspeed type, with cutting teeth at each end. Of 5-in. diameter, this cutter also is run at 24 r.p.m., and the feed rate is 1½ in. per min.

With these roughing stages completed, and the work still mounted on the Cincinnati machine, two finishing operations are performed. At the first, the annular portion is straddle milled to finished form, and witness marks of the straddle milling cut can be seen at *K* in Fig. 10. Climb milling is employed, and the two 5-in. diameter cutters are run at 51 r.p.m., the feed rate being 1½ in. per min. The second finishing stage provides for removal of the excess material between the straddle milling cuts to produce facings, as at *L*, and the webs and pads, as at *H* and *J*, respectively. Conventional milling is employed for this operation, which is performed by two 5-in. diameter cutters, run at 24 r.p.m.

SPECIAL CINCINNATI HYDROTEL MACHINE

Fig. 12 is a general view of the Cincinnati Hydrotel machine with the first roughing operation on the nozzle box in progress. This machine was specially built to Rolls-Royce specification, and has a work-table *M* and a master-table *N*, both of 42 in. diameter. These tables are connected by a train of three gears, so that they rotate in phase. Drive to the table is taken through a standard Cincinnati Hydramech unit, as fitted to HyPowermatic machines and described in *MACHINERY*, 98/831—12/4/61. This unit transmits drive from a hydraulic motor to a gear below the table, and provides for the elimination of backlash.

A 15-h.p. motor is provided for the cutter head *P*, and the spindle speed can be varied from 15 to 600 r.p.m. by means of change gears. The cutter spindle has a standard 5-in. diameter nose, with 1-in. keys, and the complete cutter head assembly is built into a ram casting which can be traversed on horizontal slideways by hydraulic power. Dovetail guideways are provided at the front of the ram to carry an arbor support bracket *R*. The cutter spindle is mounted in a quill that has limited adjustment for height, and the work is mounted on packing blocks, as at *S*, which were made by Rolls-Royce, Ltd.

Movement of the ram and cutter head, radially to the work, is controlled by the tracer valve assembly *T*. This unit is mounted on compound dovetail slideways on one side of the ram, and is adjustable vertically and transversely, relative to the master on the table *N*. The tracing control system is of standard Cincinnati type, and the disc type follower *U* is of the same diameter as the cutter. Since the follower is relatively thin, the height of the master *V* is very much less than that of the work. Grooves are machined in the periphery of the master to correspond with the various profiles to be produced on the component. The height of the follower can be readily adjusted to engage it with the required groove in the master.

Pressure oil for the table and ram motions is supplied by a pump with an output of 10 gal. per min. at a pressure of 500 lb. per sq. in. To power the main cutter spindle clutch and brake unit, the clamping arrangements for the spindle quill, the hydraulic pilot valve, and the backlash eliminating system, oil is taken from the main supply and passed through a valve which reduces the pressure to 150 lb. per sq. in. All motions of the machine can be controlled from the push-button panel at the side of the master table.

The machine has provision for varying the rotary speed of the work, so that the feed rate is kept constant, although the diameter machined may

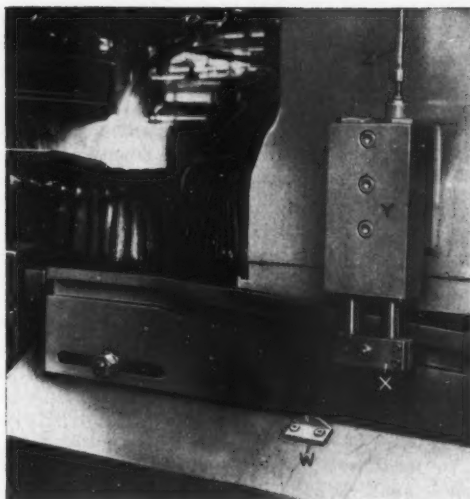


Fig. 13. The cam on the machine bed, and the follower on the cutter head ram of the specially built Cincinnati Hydrotel milling machine, which control the speed of rotation of the work-table, to maintain a constant feed rate, regardless of the radius at which cutting is being performed



Fig. 12. General view of the set-up for profile milling Conway nozzle boxes on a Cincinnati Hydrotel milling machine which was specially built to Rolls-Royce specification

range from 16 to 48 in. A cam plate is mounted on the side of the machine base, below the ram, and is seen in the close-up view in Fig. 13. This cam plate can be adjusted longitudinally to suit the diameter of the cutter employed from 0 to 10 in., and a scale, engraved on the plate, is calibrated in $\frac{1}{4}$ -in. units with every 1-in. graduation extended, and every other 1-in. graduation numbered. This scale is read with reference to an index mark on the bracket *W*. A track machined in the plate is engaged by a follower roller on the inside of the block *X*. This block is mounted on the end of ground cylindrical guide-members, which

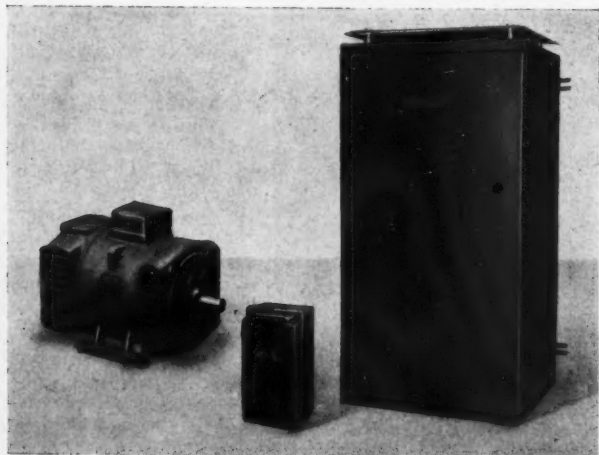
can slide in the support Y, secured to the ram carrying the cutter head. As the ram is moved relative to the work, the follower roller is raised or lowered by the cam track and this motion is transmitted by a Bowden-type cable to an auxiliary flow control valve on the tracer-head assembly. This valve provides for an additional flow of oil to the table drive hydraulic motor as the cutter advances towards the centre of the work, to increase the speed of rotation.

A further article concerned with the Aero Engine Division of Rolls-Royce, Ltd., will be published shortly in MACHINERY.

Series BMC.1 Adjustable Speed Drive

An adjustable speed drive, which can be supplied with a wide range of control characteristics, has been introduced by Lancashire Dynamo Electronic Products, Ltd. Known as the series BMC.1, the drive comprises a motor and remote mounting control station for speed adjustment, as seen in the figure. Available with ratings from 1 to $3\frac{1}{2}$ h.p., with a speed control range of 10:1, the equipment, it is stated, ensures good regulation of motor speed, even under conditions of fluctuating load.

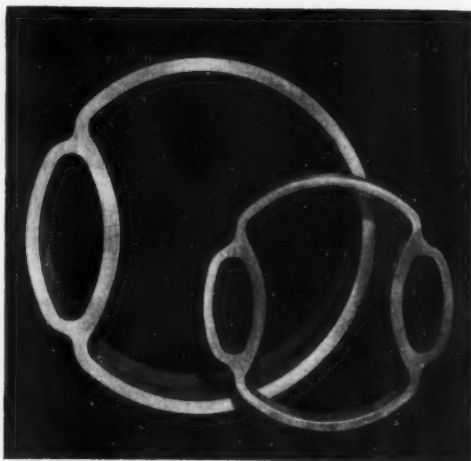
If required, provision can be made for reversing and dynamic braking, and all drives have built-in current limit protection against overloads of the motors of control equipment. Motors can be supplied with various enclosures and a wide range of basic speeds.



Lancashire Dynamo series BMC.1 adjustable speed drive

Unitrace and Duotrace Aluminium Alloy Tubes

Imperial Aluminium Co., Ltd., Kynoch Works, Witton, Birmingham, are now marketing the Unitrace and Duotrace extruded aluminium-alloy tube



Sections of Alcoa Unitrace and Duotrace aluminium-alloy tubes

manufactured by the Aluminium Co. of America. Of the cross sections shown in the figure, these tubes are designed for use in the processing of chemical and food products where liquids must be kept warm to prevent solidification when being pumped from one point to another. They are equally effective, it is stated, where liquids must be kept cool at a controlled temperature. The product is carried by the large bore, and the heating or cooling medium by the small trace bore.

These tubes are available in 30 ft. lengths and in sizes from 1 to 8 in. diameter. They are light in weight and are easily bent, but have considerable strength, and the integral construction ensures good thermal characteristics.

Special flange fittings enable lengths of tube to be bolted together with standard flanges, or to jacketed fittings by means of adapter flanges.

Planning for the AEI Numeritrol Numerical Control System

By A. W. ASTROP, Associate Editor

THE NUMERITROL NUMERICAL CONTROL SYSTEM for machine tools, which was developed by the Electronics Apparatus Division of Associated Electrical Industries, Ltd., Leicester, is of the magnetic tape type, and was described in *MACHINERY*, 99/77—12/7/61, where reference was also made to its application to a Newall type 1520 CC jig boring and milling machine. Before discussing the planning and programming procedures associated with the system, it may be useful to recall, however, that digital information recorded on the tape is used to transmit signals to servo-mechanisms for the three main machine motions, namely, longitudinal, transverse and vertical, also for the control of auxiliary machine functions. For each of the main movements there is a separate Helixyn unit whereby the actual displacements of the slides are continuously monitored and measured, relative to a datum point, which may be chosen anywhere within the limits of the machine movements during the initial setting-up of a work-piece blank, and this information is fed back to a control unit. The arrangement is such that the servo systems seek continually to equate the demanded and actual positions of each slide, and will move the latter until the two signals coincide.

From the receipt of a working drawing of a given component to the loading of a suitably-recorded tape into the controller, four basic stages must be completed. Stage 1 involves filling in special planning sheets with the relevant dimensional and ancillary information, from which a punched paper tape (Stage 2) is prepared on a teleprinter machine. Alternatively,

this tape can be prepared at the AEI Service Centre, Leicester, from information supplied by the machine user. Simultaneously with the punching of this tape (which is identified as tape A), the teleprinter produces a typed copy of the data, which can be used for checking purposes. Tape A is then despatched to the AEI Tape Service Centre at New Parks, Leicester, where it is fed through a general-purpose computer. The data on tape A is of a basic nature, and defines the periphery of the workpiece in terms of change points in the directions of movement of the cutter, and the general purpose computer converts this positional information into terms of points on the path to be followed by the centre of the cutter, in order to facilitate the next stage in the computing procedure. These data are in the form of a second punched-paper tape—identified as tape B—which is then fed to a special-purpose computer. Known as the "Director," this computer transfers the data on tape B to a 4-track magnetic tape, in the form

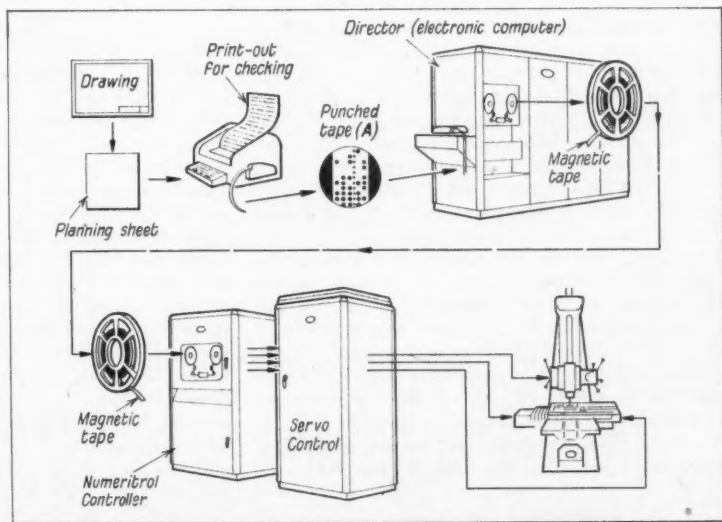


Fig. 1. Diagrammatic representation of the various stages in producing a magnetic tape for a machine under AEI Numeritrol control

In group 2 there are two symbols only, namely, 10 and 20, which signify that cutting is to take place on the right-hand side or the left-hand side of the tool, respectively. These digits can be added to any of those in the first group, as required. There are five different symbols in the third group, namely, 70, which is an instruction to set the X, Y and Z datums; and 31 and 41, denoting the last and first in a sequence of tool centre steps. The symbols 31 and 41 indicate "entering" and "leaving" a section of the programme in which the co-ordinates quoted refer to the *profile* of the workpiece. Otherwise, co-ordinates refer to tool-centre positions, as when drilling, picking up

reference holes, etc. Finally, symbols 6 and 7 are employed for optional and compulsory stops, respectively. An optional stop is one which the control system will obey only if the operator has set an associated switch, otherwise it will be ignored. Such stops are included by the planner at his discretion, when it is thought that it may be useful for the operator to inspect the workpiece or the tool at any given stage of the machining, for example. Compulsory stops are inserted at stages where it is necessary to change tools, for instance.

Mention may be made here of pauses, or momentary halts, which are required in the machine motions immediately prior to an abrupt change in direction of the cutter path. Provision is made for such pauses at the planning stage by inserting a minus sign in front of the Instruction Digit of the step after which the halt is required. Provision can be made for a maximum of seven different auxiliary instructions for the machine tool, such as turning coolant on and off, by means of a group of decimal-type digits. Examples are .004, .040 and .200, and these digits are inserted immediately after the appropriate Instruction Digit, being separated from it by the decimal point. If combined instructions for a number of auxiliary functions to be performed simultaneously are to be given, the appropriate decimal-type digits are added together, the values having been selected such that any given total can represent only one particular combination.

The auxiliary functions represented by each of the decimal-type digits are constant for any given machine tool, and are recorded, among other permanent information, on a Machine Data Card. One of these cards is made out for each machine tool which is under Numeritrol control, and provides all the relevant basic information about that machine which the planner requires before planning starts. A typical card is shown in Fig. 2, and is largely self-explanatory. Information is given concerning the maximum movements of the machine in the X, Y, and Z axes, number of T-slots, pitch of T-slots, spindle speeds, horsepower, etc. The head-

ing "Sense of Scales," approximately half-way down the card, refers to the scales which are incorporated as part of the measuring equipment of the machine, and the direction in which they read relative to motion in the X, Y and Z axes.

Maximum acceleration and allowed acceleration are values which are determined as a result of tests to establish the responsiveness of the servo-system of the machine, and the values inserted are peculiar to that machine only. At the bottom of the card, provision is made for allocating the various auxiliary functions of the machine to the numbers between 3 and 9.

Another non-dimensional convention in planning procedure relates to the machining of circular arcs, in that convex and concave shapes are identified by prefixing the relevant radius with a plus or a minus sign, respectively. Finally, mention may be made of certain restrictions which the planner must bear in mind when setting out the data for a workpiece. An external sharp corner must not follow the last step in a tool centre sequence (digits 31, see above), nor precede the first step in a tool centre sequence (digits 41, see above). At the start of a (31) step and at the end of a (41) step, the cutter must clear the workpiece in the X and Y axes by at least 0.040 in.

From a dimensional standpoint, the planner is obviously restricted in the X, Y, and Z axes to the maximum slide movements of the machine. Finally, radii on workpieces are restricted to a maximum of 1,700,000 in., and internal radii to a minimum of (cutter radius + 0.001 in.).

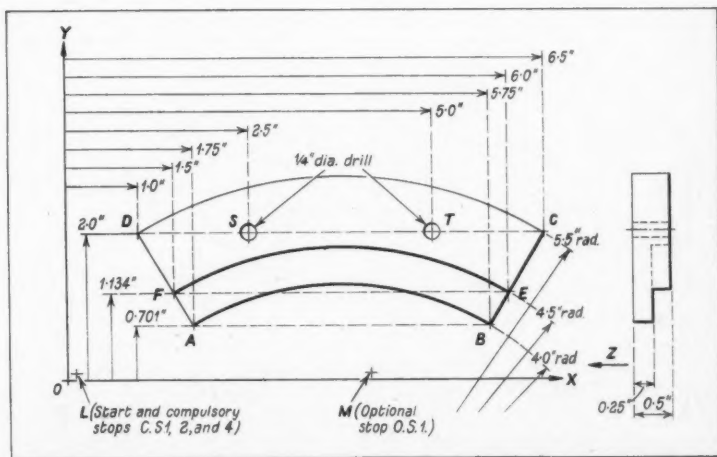


Fig. 3. Typical workpiece showing the recommended method of setting out co-ordinate dimensions

AN EXERCISE IN PLANNING FOR A TYPICAL WORKPIECE

In Fig. 3 is shown a sample workpiece—an arcuate clamping member with a stepped cross-section—which will serve as an example to demonstrate a typical planning sequence. When brought to the Numeritrol-controlled machine, the blank already incorporates the $\frac{1}{4}$ -in. diameter drilled hole S which is to serve as a workpiece datum. It will be noted that the dimensional datum point is located beyond the periphery of the workpiece, and that the layout of dimensions conforms to the convention stated above.

It is assumed that the workpiece will be mounted on spacing blocks and will be clamped by bolts which pass through services holes in the blank (not shown) and engage with T-nuts in the work-table. Attention is now drawn to Fig. 4 where the complete planning sheet for this workpiece is reproduced.

The function of each instruction included on the planning sheet is noted briefly in the section at the right, headed "Notes," to facilitate identification of the sequence step by step. Step 1 provides

for setting the machine spindle relative to the hole S, Fig. 3, and the X and Y co-ordinates for this hole are written in their respective columns—namely, 2.5 and 2. A zero value for the Z datum will suffice where it is required (as in Step 5) and a zero is therefore written in the appropriate column. At the machine, the spindle is aligned with the hole S by the operator, who inserts a centring gauge in the spindle and moves the worktable under hand control. Having aligned the spindle in this manner, the operator then "zeros" the X and Y Helixys, and the control system is thus set relative to the datum hole S. Instruction to the operator for this procedure, also for setting the machine in the Z axis, changing cutters, and any other similar information, is set out on a Machining Instruction Sheet which is compiled by the planner, and to which further reference will be made later.

It will be noted that Step 1 also includes the digits 70, in the column headed Instruction, which is the code for "set X, Y and Z starting points." Steps 2 and 3 are connected, in that they form what is termed the starting sequence, namely, the

Ø — CRLF A J Ø 2.0 CRLF (Title) CLAMP										Prog. Ser. No. n 24
										Prog. 1 of 1
										Sheet 1 of 1
n 24 (date) CRLF Ø Ø Ø — CRLF										NEWALL 15/20
Step	Instruct.	X or Tool dia	Y	R	Z	Z Feed	* XY Feed	Accel.	Notes	Stop No.
1	70	2.5	2		0		10	0.1	Starting position at hole S	
2	5	4							Pause stop-4 sec	
3	7								Starting sequence	
4	1	0.0424	0.0544						Move to point L	CS1
5	7								Put in $\frac{1}{4}$ " drill set Z datum to spacing block	CS2
Ø — CRLF										
6	1	5	2		-0.512	10				
7	0				0.2	1			Drill hole T	
8	0				-0.512	10				
9	1	0.0424	0.0544		-0.6142	0			Move to point L	
10	7	1.0							Put in 1" cutter	CS3
Ø — CRLF										
11	31	1.75	0.701						Move to point A	
12	11	1	2				2		Edge AD	
13	2								External corner at D	
14	2	6.5	0.8	5.5					Edge DC	
15									External corner at C	
Ø — CRLF										
16	1	5.76	0.701						Edge CB	
17	2								External corner at B	
18	2	1.75	0.8	-4					Edge BA	
19	41	4.136	0.0544						Move to M	
20	6								Optional stop at M	OS1
Ø — CRLF										
21	31	6	1.134		-0.25	10			Move to E	
22	-12	1.5	0.8	-4.5			2		Edge EF	
23	41	0.0424	0.0544				10		Move to point L	
24	0				0	10				
25	7									CS4
Ø — CRLF * A END										
N.B. Terminate each line with = CRLF										
										Machine
										Workpiece
										CLAMP
										NOTE: Finishing cut made by repeating CS3 to CS5
										Job No.
										Customer
										Drawing
										Sketch
										Initials
										Date
										AEI NUMERITROL
										Planning Sheet

Fig. 4. The planning sheet for the workpiece shown in Fig. 3 is here reproduced in entirety

Table of Grid Points for a Helixyn of 0.1024-in. pitch.										
0	0	1	2	3	4	5	6	7	8	9
0	0	0.1024	0.2048	0.3072	0.4096	0.5120	0.6144	0.7168	0.8192	0.9216
10	1.0240	1.1264	1.2288	1.3312	1.4336	1.5360	1.6384	1.7408	1.8432	1.9456
20	2.0480	2.1504	2.2528	2.3552	2.4576	2.5600	2.6624	2.7648		
30	3.0720	3.1744	3.2768	3.3792	3.4816					
40	4.0960	4.1984	4.3008							
50	5.1200	5.2224	5.3248							
60	6.1440	6.2464	6.3488							

Fig. 5. Portion of the table of zero points which is supplied by A.E.I., Ltd., to facilitate locating the grid points of the Helixyn measuring system

point at which the machine first comes under complete tape control. Steps 2 and 3 provide a "pause" of 4 sec., followed by a stop, during which the operator locates the starting point on the magnetic tape.

Step 4 it will be noted provides for a "move to L" (see insertion in column headed Notes). This move brings the machine spindle to a convenient position for setting the height of the tool. The position L is shown by crossed lines in Fig. 3. For convenience, this arbitrary point is chosen to be a "grid point," as it is termed. As described in the previous article on the Numeritrol control system, the actual displacement of each machine slide is monitored continuously by means of a Helixyn unit which is a bar incorporating helically-wound conductors. Embracing, and clear of this bar, there is a sleeve, the bore of which is also provided with helically-wound conductors. Electrical pulses are transmitted to the sleeve and as a result of the capacitive coupling between this member and the bar, signals are induced in the latter and are fed to the servo-control system. The signals are of cyclic nature, and recur at 0.1024 in. intervals, in terms of travel of the sleeve.

Considering the Helixyn units for the X and Y axes, therefore, an imaginary grid can be visualized, composed of a number of 0.1024-in. squares, the long side of the grid being equal to the length of the X axis Helixyn, and the short side to the length of the Y axis Helixyn. The point L is located with the aid of a Table of Grid Points which is provided by A.E.I., Ltd., for the use of the planner. A portion of this table is reproduced in Fig. 5, and it sets out the values of the expression $n \times 0.1024$, where n is any whole number from 1 to 200.

For the workpiece shown in Fig. 3, the grid point L is located in the following manner. The workpiece datum (hole S) is 2.5 in the X axis from

the dimension datum 0. From the table of grid points, Fig. 5, it will be seen that the nearest figure to 2.5 is 2.4576, and that the nearest figure to 2.0 (the position of the hole S in the Y axis) is 1.9456. By subtracting the grid values from the drawing values (namely, 2.5 - 2.4576 and 2.0 - 1.9456) the position of the grid point L in the X axis becomes 0.0424, and in the Y axis 0.0544, and these figures are inserted in the appropriate columns for Step 4. It may be mentioned, however, that there is no necessity to select the grid point which is nearest to the datum 0. As stated above, its position is purely arbitrary, and is selected entirely for convenience, bearing in mind the design of the work-holding fixture, for example, and the position at which a height gauging block can most easily be accommodated. The Instruction for Step 4 is the code digit 1, which it may be recalled represents a straight line movement.

It will be noted that between Steps 4 and 5, the Planning Sheet is overprinted with the combination ϕ -CRLF, which is an instruction to the teleprinter operator to operate the Blank Tape Run Out, followed by Carriage Return, Line Feed. This instruction appears after every five steps in the planning sequence and consequently provides for "separation" of the data on the punched tape, at regular intervals. With this arrangement, location of any specific instruction on the tape is greatly facilitated.

Step 5 is a Compulsory Stop (code 7 in the Instruction column) since the operator is required to insert a $\frac{1}{4}$ -in. diameter drill in the spindle in readiness for machining the hole T, Fig. 3. At the same time, the operator will lower the spindle by hand until the drill point touches the top of one of the spacing blocks on which the workpiece is mounted, thereby establishing the Z datum. Finally, he nulls the Z axis Helixyn.

MAGNETIC TAPE			OPERATIONS	STOP	FEET	POSITION OF M/C MOVEMENTS			LOCATE		CUTTER	SPINDLE SPEED	FEED	NOTES	PROG. N 24
PROGRAM SERIAL No	SEQUENCE LETTER	REEL No				X	Y	Z	STOP	FEET					
N24	A	36				2.5	2.0		A/C51	005					MACHINE
			Drill hole T	A/C52	023	0-0424	0-0544				1	600		2	NEWALL 15/20
			Mill edge AUCBA Roughing	A/C53	081	"	"	0-6144			2	1200	0-010	2	WORKPIECE
			" EF cut	A/C55	675	0-0424	"	"	A/C53	081	"	"		3	CLAMP
			Finishing cut	A/C54	638	4-1360	"	"			"	"			
				A/C55	675	0-0424	"	"			"	"			

CUTTER DETAILS		
No	TYPE	NOM. DIAM.
1	Drill	1/4"
2	Slot Drill	1"

NOTE	NOTE
1. Locate centre hole S. Null out X and Y helixys. Raise in Z by hand to clear workpiece.	
2. Set tool to top surface of spacing block. Null out Z.	
3. Measure workpiece and put in appropriate tool radius compensation.	

A.E.I. NUMERITROL.	
MACHINING INSTRUCTION SHEET	

Fig. 6. This Machining Instruction Sheet is made out by the planner and incorporates all the information required by the machine operator for producing the workpiece seen in Fig. 3

Step 6 provides for moving the spindle to the required position for drilling the whole T, the code 1 in the Instruction column indicating a straight line movement, and the X and Y ordinates appearing in the appropriate columns. While the table is moving to the required position, the spindle is also being raised, rapidly, so that the drill point clears the edge of the workpiece. A high feed rate is therefore specified for the spindle traverse (10 in. per min. in the Z feed column), but is restricted to not more than 32 times the XY feed rate. Column Z, for Step 6, shows an entry of 0-512, which is the nearest grid point to 0.5 in. from the Z datum, in other words, the top face of the workpiece, and provides for the spindle to be stopped with the drill point 0-012 in. clear of the work.

Steps 7 and 8 provide for drilling the hole T at a feed rate of 1 in. per min., the drill being fed down until the point is 0.2 in. below the bottom of the workpiece, and returning the spindle (at 10 in. per min. feed rate) to its starting position. It should be noted that Steps 7 and 8 call for movement in the Z axis only, and that the code digit 0 is therefore inserted in the Instruction column.

After the hole T has been drilled, Step 9 provides for returning the spindle of the machine to the position L, Fig. 3, preparatory to milling the periphery of the work.

The remaining stages in the planning are largely self-explanatory, and reference will be made only to items of particular importance or interest. The identification letters included in the section of the Planning Sheet headed Planner's Notes refer to change points on the workpiece, and correspond to those shown in Fig. 3. The Instruction for Step 11 is 31, which denotes a "last tool centre step," and the system automatically arranges for a momentary halt in connection with this Instruction (also 41). The code digits 2 which appear in the Instruction column for Steps 13 and 14 indicate that minor arcs are to be cut.

Attention is drawn to the entries in the X, Y, and R, columns for Step 14. This step provides for milling the convex curve DC, Fig. 3, and the information required comprises only the X axis ordinate for the point C and the radius of the curve, namely, 5.5 in. The ordinates for D were inserted at Step 12, and O* is entered in the appropriate

column. (The suffix* denotes that this step is an increment.)

For the same reason, an asterisk is included after the O in the Y axis column for step 18. Since this curve is concave, the value of the workpiece radius in the fourth column is prefixed by a minus sign.

Finally, it will be noted that at Step 20 there is provision for an Optional Stop (code digit 6). This stop follows a move by the spindle to the position M, Fig. 3, immediately after the curve BC has been machined. At this stage, the periphery of the workpiece has been completely machined, and the operator may wish to inspect the finish, also the condition of the cutter, before proceeding to mill the stepped portion EF. The position M is a grid

point, selected conveniently clear of the workpiece, and is represented by the entries in the X and Y columns for Step 19. Information regarding movement of the spindle in the Z axis to cut the step EF to the required depth is included in the appropriate column for Step 21.

Mention has already been made of a Machining Instruction Sheet which is made out by the planner and is issued to the machine operator for guidance. The Machining Instruction Sheet for the workpiece in Fig. 3 is shown in Fig. 6, and contains all the information required by the operator, including the tape footage relating to each stop point, so that the tape can readily be rewound to a specified position, for replay for example.

Small Stainless Steel Camera Components Produced by Powder Metallurgy

Until recently, difficulty has often been experienced in sintering parts made from stainless steel powders because of their low green strength. Improved powder metallurgy techniques have, however, been developed by the firm of Dixon Sinteralloy Inc., Connecticut, U.S.A., which are stated to permit the economical production of components from A.I.S.I. type 316 stainless steel as well as stainless steels in the 300 and 400 series.

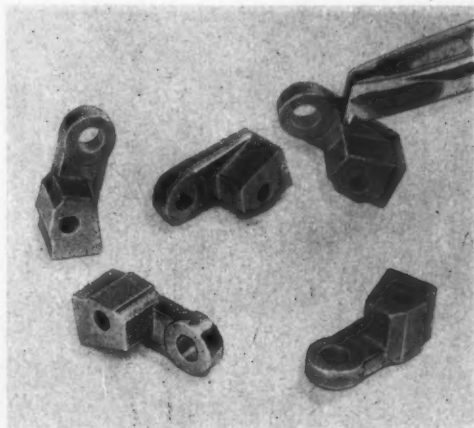
Where intricate shapes are involved, and resistance to corrosion is important, fabrication from stainless steel powders offers considerable advantages. Other metal powders, which are easier to process, may be used in some instances, but for corrosion resistance it is then usually necessary to rely on a secondary operation, such as sealing or electro-plating.

Sintered stainless steel has proved suitable for components for sports equipment exposed to the weather, bearings, cams, gear trains for water meters, and parts for food-vending machines, medical equipment, and cameras. Among the latter are components known as "jammers," as shown in the accompanying illustration, which are employed for locking in position the lens and shutter unit of a Polaroid electric-eye camera.

The decision to produce these items by powder metallurgy was taken after difficulty had been experienced in machining the rather complicated shape to the close tolerances specified. These parts, of which there are right- and left-hand forms, are less than $\frac{1}{8}$ in. long.

A die with only two impressions is employed which produces one left-hand and one right-hand part, and complete interchangeability is thus

ensured. After sintering, a final coining operation is performed to size the part, the limits on the thickness of the pad portion, for example, are ± 0.001 in. The bearing holes must be accurately square to the flat surfaces, and when a pair of parts is assembled in the camera, the holes must be concentric within 0.002 in. total indicator reading. These components, which are stated to be among the smallest produced in stainless steel by the company, are being made in large numbers.



Small components for cameras produced from stainless steel powder by means of improved techniques developed by Dixon Sinteralloy Inc. U.S.A. Less than $\frac{1}{8}$ in. long, these parts are employed for locking the lens and shutter unit of a Polaroid electric eye camera

The Activities of Paterex, Ltd.

By G. W. MASON, Associate Editor

PATEREX, LTD., recently vacated their premises at Kidbrooke Park Road, London, S.E.3, and have occupied an entirely new factory at Cray Avenue, St. Mary Cray, Orpington, Kent.

The company is engaged in the quantity production, on a contract basis, of a wide range of components from steel bar. Many of these components are intended for aircraft and gas turbines, and are made to close dimensional tolerances, and with a high surface finish, from Nimonic and heat resisting steel. Some 250 people are employed at the new factory, which has a floor area of 35,000 sq. ft.

At the Cray Avenue works, the production equipment available includes a total of 105 single-spindle automatics with bar capacities up to 1½ in., 40 capstan lathes, 10 centreless grinders, and two thread rolling machines. In addition there is a Cri-Dan high-speed automatic screwcutting lathe and a thread milling machine, also cylindrical grinders, bench-mounted centre lathes, small-capacity milling machines, and drilling machines, on which second operations are carried out on certain components.

These machines are housed in a single well-lit shop, at the sides of which there are separate departments for inspection, barrel finishing of workpieces, storing of considerable quantities of steel bar, and separating cutting oil and swarf. Some of the automatics may be seen in Fig. 1, which gives a view of part of the shop. About 45 people are normally employed for the inspection of completed workpieces, which is carried out on a 100 per cent basis, in most instances to A.I.D. requirements.

Whereas certain components are made by Paterex, Ltd., in fairly small numbers, others are produced in considerable quantities, and the volume of orders handled by the company is such that the automatics, and most of the second-operation machines are maintained in continuous production. Work has already been started on the construction of extensions to the factory, which, when completed, will provide an additional 6,000 sq. ft. of manufacturing space.

Fig. 2 is a close-up view of a Scrivener No. 1 centreless grinder, fitted with a roll crushing attachment A, which has been made by the com-

pany for dressing multiple ribs of radiused form on the grinding and control wheels, as required for plunge grinding brass roller comb components for electric shavers. For dressing, the crushing roll is brought between the grinding and control wheels by movement of the arm on which it is mounted through 180 deg. from the position shown. The control wheel is then run at a higher speed than is employed for grinding, which is engaged by movement of a lever on the 2-speed motor driving unit mounted on the head. During the dressing operation, the grind-



Fig. 1. In this view may be seen some of the single-spindle automatics installed at the new St. Mary Cray works of Paterex, Ltd.

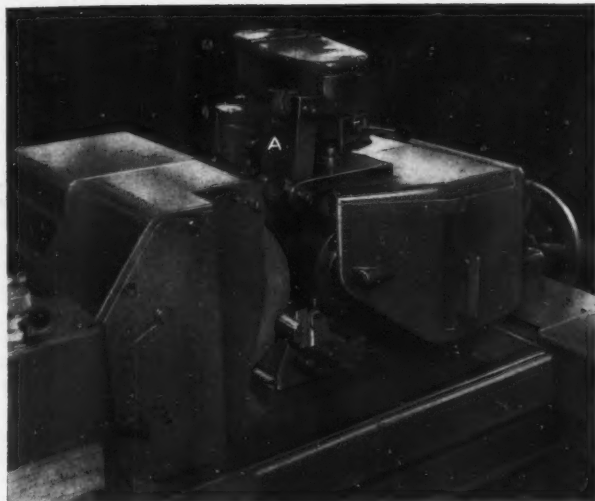


Fig. 2. Close-up view of a Scrivener No. 1 centreless machine fitted with a roll crushing attachment and set up for grinding roller comb components for electric shavers

ing wheel is turned by the action of the crushing roll. This machine, and others of similar type installed at the St. Mary Cray works, is fitted with an air-operated workpiece ejector, of the company's design, which is brought into use by means of an air valve. This valve is actuated by the sliding-type cam for controlling the traversing movement of the control wheel-head, when the latter is being moved in a direction away from the grinding wheel at the end of the working cycle.

Special nuts for the aircraft industry are produced in large numbers, and Fig. 3 is a close-up view of a machine, with certain covers removed, which has been built by the company for chamfering the bores in blanks at both ends prior to tapping. Blanks are loaded into the centre-board type hopper *B*, and are delivered by way of chutes at both sides into radially-extending slots at the peripheries of two indexing carriers. Drive from the motor is taken by a belt to the transverse shaft *C*, and thence by spiral gears to the shafts *D*. From these shafts, the individual cutter spindles are driven through Tufnol gears. The

spindles in each pair can be adjusted independently for depth of cut, and are off-set so that, during the working cycle, countersinking is carried out simultaneously at the rear end of a blank at one position in the carrier, and at the opposite end of another blank at the next position.

A worm at the centre of the shaft *C* is in mesh with a wormwheel, which, through the shaft *E*, drives a Geneva mechanism for indexing the work carriers, also a crank for imparting reciprocating motion to the centre board in the hopper *B*. Feed is applied to the individual spindle heads, which are arranged to slide on guide-ways on a base, by a barrel-type cam mounted on the shaft *E*, close to the wormwheel. Motion is imparted to each spindle head by a lever fitted with a follower roller which engages with the track in the cam. At the ends of the levers there are gear segments which mesh with racks attached to rods connected to the individual spindle heads. With this arrange-

ment, the spindle heads are traversed towards and



Fig. 3. The machine shown in this close-up view has been built by Paterex, Ltd., for chamfering both ends of bores in nut blanks on a fully-automatic cycle

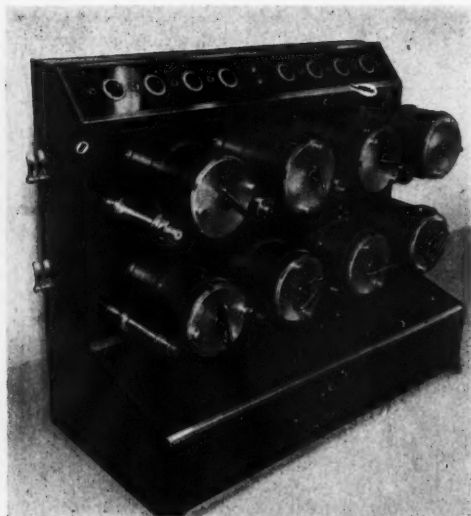


Fig. 4. Paterex, Ltd., have built this multiple-barrel finishing machine to meet their particular requirements for handling fairly large batches of small components. The barrels can be removed from the machine for loading and unloading workpieces, and are driven individually, under the control of separate timers

away from each other for the chamfering and return strokes. The levers are so disposed that chamfering is carried out by one pair of spindles during the return stroke of the other pair.

When a pre-set torque is applied to the shaft E, for example, in the event of a blank becoming jammed between the end of a chute and an indexing carrier, a plunger at the upper end is moved in an axial direction, to operate a micro-switch to stop the machine. The wormwheel, spiral gears, and cam run in an oil bath. Interchangeable work carriers can be fitted to take nut blanks with bores of different diameters up to $\frac{1}{2}$ in. As an indication of the productive capacity of the machine, it is stated that stainless steel nut blanks of the largest size that can be handled, can be chamfered at the rate of 280 per min.

Freedom from burrs and sharp edges is specified for most components made by Paterex, Ltd., particularly those required for the aircraft industry, and the multiple-barrel finishing machine shown in Fig. 4 has been built by the company to meet their special need for handling fairly large batches of a variety of small items. There is a total of eight rubber work barrels, each of which has an

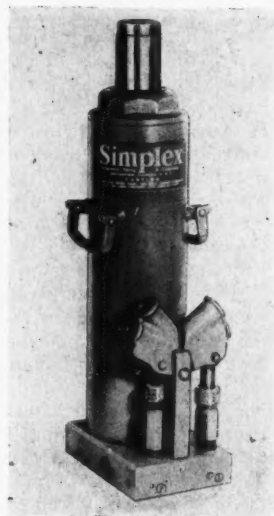
internal diameter of $8\frac{1}{2}$ in. and is 13 in. long. Any barrel can be removed from the machine independently for loading and unloading workpieces, which can be carried out while finishing of other components within the remaining barrels proceeds. When a batch of parts has been loaded into a barrel, an end cover is fitted, and the barrel is then mounted on friction discs on a pair of horizontal driving shafts. Drive to these shafts is taken from a single motor, through a roller chain and sprockets, and separate solenoid-operated clutches. Interchangeable friction discs of different diameters can be mounted on the driving shafts to give barrel speeds of 40 and 60 r.p.m.

The clutches for transmitting the drive to the individual pairs of shafts are engaged by levers at the ends of the machine, and the periods for which barrel finishing is to be carried out on the various batches of workpieces, can be pre-set independently by means of separate timers. When the pointer on a particular timer has been brought to the zero position at the end of the pre-set period, the corresponding clutch is disengaged by means of a solenoid, to stop the work barrel.

Simplex Type 50H26 Hydraulic Jack

In the figure is shown the Type 50H26 hydraulic jack of 50 tons capacity, which has been added to the Simplex range marketed by the Equipment & Engineering Co., Ltd., 2 & 3 Norfolk Street, London, W.C.2. This jack has a lowered height of only 26 in., but permits the relatively high lift of 20 in. to be obtained.

High- and low-speed, hand-operated pumps are provided which can be used separately or in unison, and the jack, which is equipped with Neoprene seals and spring-loaded ball valves, may be employed horizontally or vertically.



Simplex type 50H26 hydraulic jack

Slack & Parr Unit Head Machines

By G. W. MASON, Associate Editor

SLACK & PARR, LTD. (MACHINE TOOL DIVISION), Kegworth, near Derby, who are well known as makers of multi-spindle drilling attachments of fixed- and adjustable-centre types, have built a number of air-hydraulic machines incorporating unit heads of their own design, for performing drilling, tapping, reaming, and countersinking operations, for example, on particular components. Townsend-Coates, Ltd., 167 London Road, Leicester, have been appointed sole agents for special-purpose machines built by Slack & Parr, Ltd., some examples of which are here described.

With a typical unit head made by the company for drilling and reaming, a slide which carries the motor-driven spindle assembly is mounted on rectangular guideways on a base member, and feed and rapid traverse movements are provided by an air-hydraulic system. During the drilling stroke, fluid is delivered to the piston-rod end of the hydraulic traversing system by compressed air from the shop supply, which is applied to the upper end of an air-oil reservoir. At the same time, fluid which is discharged from the other end of the traversing cylinder is passed to a second reservoir, through a one-way restrictor valve, and the latter can be adjusted for varying the feed. At the end of the stroke, a 4-way air valve is reversed, with the result that fluid from the second reservoir is delivered to the traversing cylinder, to return the slide to the starting position. When the unit is operated by compressed air at 80 lb. per sq. in. pressure, a thrust of about 450 lb. is applied to the slide during the drilling stroke. The slide normally has a working stroke of 4 in., and the space occupied by the base is 17% by 8½ in.

The machine shown in Fig. 1 incorporates two unit heads, and is intended for drilling, countersinking and tapping closely-spaced holes in bronze piston components for motor-car disc brakes in a cycle time of 8 sec. Two interchangeable work-holding fixtures have been supplied

for mounting on the 12-station indexing head at the left-hand end of the base, to take components of different sizes. Components to be drilled and tapped are held in the fixture by eccentric-type clamps, which are tightened individually by means of radially-extending levers. The working cycle is started by a push-button type air valve, and the fixture is then indexed by a Geneva mechanism through a rack and pinion. At the end of this movement, an air-operated slide mounted on the base between the drilling head A and the tapping head, is advanced so that a pair of probes enter the holes in the piston at the 6 o'clock position on the fixture, which was drilled at a previous cycle. When the slide has been moved to its full extent, a micro-valve is operated to start the drilling operation. A pair of ⅜-in. deep holes is then drilled in the component at the 9 o'clock position on the fixture in readiness for tapping 4 B.A. At the same

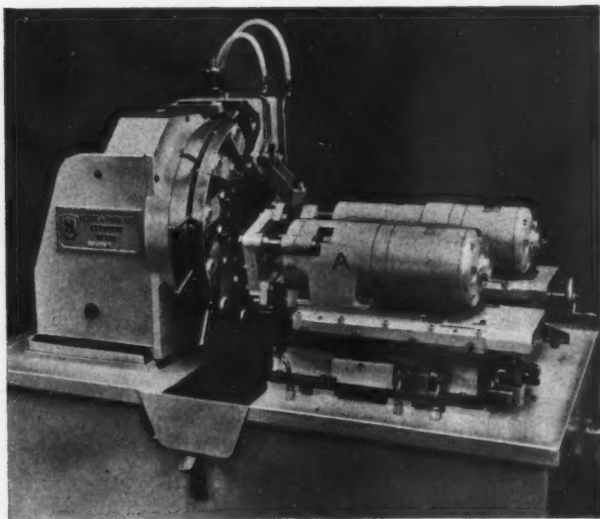


Fig. 1. This Slack & Parr unit head machine is designed for drilling and tapping 4 B.A. by ⅜-in. deep holes in pistons for disc brakes. Interchangeable work fixtures are provided for handling parts of different sizes, and separate sets of cutter spindles on the unit heads can be brought into use for drilling and tapping holes at a centre distance of ⅜ or ⅝ in.

time, the holes in the piston at the next position, which were drilled at the previous cycle, are countersunk by twist drills mounted on the same head.

At the beginning of the drilling operation, a cylindrical guide bar attached to the spindle head slide enters a guide bush in the fixture, which is thus located positively for angle. A cam on the spindle head slide then operates a micro-switch, which starts the $\frac{1}{4}$ -h.p. driving motor for the tapping head. From the spindle of this head, drive is taken by gears to a leadscrew in mesh with a nut, and the resulting feed per rev. is slightly less than the pitch of the threads to be cut in the work. Since the taps are mounted in floating-type holders, they can move independently of the spindle head slide under the cutting action to compensate for the difference between the feed and the thread pitch. At the beginning of the tapping stroke, an air valve is opened to deliver cutting fluid in mist form to the taps. When the holes have been tapped for their full depth, an adjustable cam on the spindle head slide operates another micro-switch to reverse the driving motor. At the end of the return travel of the slide, another cam actuates a third micro-switch to stop the motor. The slide can be advanced by means of a handwheel attached to the leadscrew, also "inched" in either direction, by push-buttons, to facilitate setting.

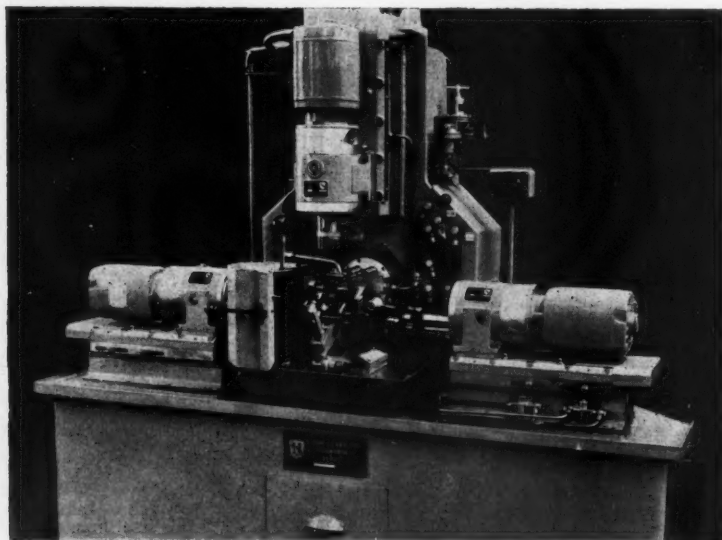


Fig. 2. Four unit heads are incorporated in this machine for drilling and spot-facing a light-alloy ball component for a vacuum cleaner

During each indexing movement of the fixture, the operating lever for one of the clamping arrangements is depressed by a striker plate, to release the completed component at the 12 o'clock position, and it is then ejected by an air cylinder, to be discharged from the machine by way of a chute. At the end of the working stroke of the drilling head, a valve is opened, and a supply of compressed air is delivered to the locating pieces on the fixture at the 12 o'clock position to remove any swarf. Simultaneously, compressed air is delivered through a nozzle assembly to the work-piece between the countersinking and probe positions, for removing swarf from the drilled holes.

The centre distance between the holes is $\frac{3}{8}$ in. on certain components, and $\frac{1}{2}$ in. on others, and the Slack & Parr gearless-type attachments mounted on the drilling and tapping heads have separate sets of spindles which can be readily brought to the working positions, as required. For changing the set-up on the drilling unit, the slide is brought to its extreme right-hand position, and two cylindrical guide bars, which pass through bores in the main spindle head and the carrier for the multiple spindles, also through guide bushes in the drill bush plate, are first removed. The spindle carrier and the drill bush plate are then turned through 90 deg., and the guide bars are passed through another set of bores in the carrier and bushes in

the plate, but through the same bores in the main spindle head. The twist drills are now removed from one set of spindles and are mounted in the other set. No guide bush plate is provided on the tapping unit, and for changing the set-up, the carrier for the multiple spindles is turned to the required position. Different probes can be brought into use as required, depending upon the centre distance of the holes in the work, by reversing the carrier on which they are mounted.

In Fig. 2 is shown a unit head machine which has been built by the company for carrying out drilling and spot-facing operations on a

light alloy bail component for attaching the handle to the body on a domestic vacuum cleaner. This machine incorporates four unit heads, three of which—for drilling operations—are arranged horizontally at right-angles to each other, and the fourth—for spot-facing—vertically on the column. The left-hand head provides for drilling a single hole, and the right-hand head two holes, of 8.1-mm. (0.319-in.) diameter, and the spindles are run at a speed of 1,450 r.p.m. A No. 31 size hole is drilled in the work by the unit at the rear, which has a spindle speed of 3,380 r.p.m. The vertical unit is fitted with a Prolite spot-facing cutter, and the spindle speed is 1,000 r.p.m.

When a component has been loaded into the fixture, a door at the left-hand side is closed by hand and this action serves to operate a valve, with the result that the part is secured by a toggle clamp operated by an air cylinder, the coolant supply is turned on, and the working cycle is started. At the same time, compressed air is passed to another cylinder, which serves to hold the door in the closed position while machining is in progress. Movement is imparted to the spindle head slide on each unit during the working stroke by compressed air which is delivered to one end of the traversing cylinder. Hydraulic fluid which is discharged from the other end of the cylinder is passed to a reservoir by way of a regulator valve which provides for varying the feed.

The machine is set so that the right-hand head is brought to the end of its working stroke after drilling and spot-facing have been completed by the other units. Operation of a valve, by an adjustable stop on the right-hand head, then causes compressed air to be delivered to the reservoir, and the slides of all the units are returned to their starting positions hydraulically. When the slide of the right-hand head has been brought to the end of its return stroke, another valve is operated by a second adjustable stop, with the result that the work-holding clamp and the door are released,

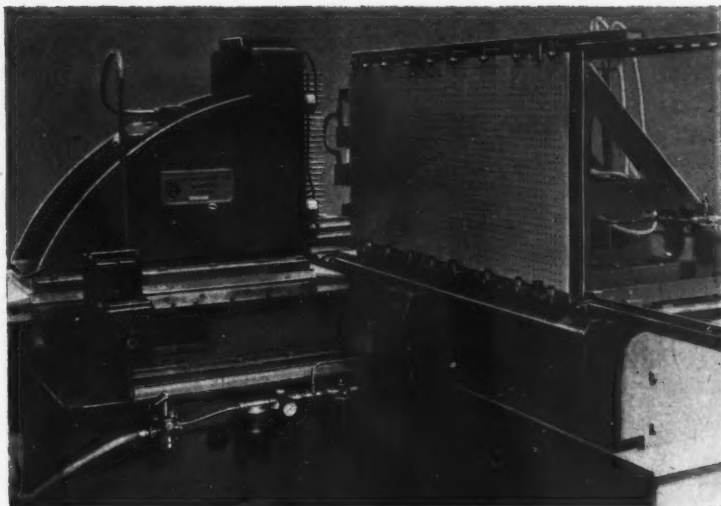


Fig. 3. A 60-spindle unit head machine for drilling holes in acoustic-insulating boards on an automatic cycle. The slide for the work-holding fixture is indexed by an air cylinder, and located at the various drilling positions by pins in conjunction with an air-operated plunger

to enable the completed workpiece to be removed.

A MULTI-SPINDLE MACHINE FOR DRILLING ACOUSTIC-INSULATING BOARDS

The machine shown in Fig. 3 incorporates a 60-spindle head, and is designed for drilling acoustic-insulating boards which have surface areas of 2 ft. by 2 ft. and 4 ft. by 2 ft. The board to be drilled is held in contact with the vertical surface of the fixture, as shown, by a number of upper and lower air-operated clamps. For loading, the board is passed between sets of rollers at the top and bottom of the fixture, which engage with the edges and the front face, and is brought into contact with an end stop.

Mounted on guide bars which are fitted with bellows-type guards, the fixture slide is traversed by an air cylinder to move the board from one drilling position to the next. The slide is located at the different positions by means of pins in a plate at the rear of the fixture, which are set at a centre distance of 1½ in., and are brought, in turn, into contact with an air-operated plunger. When the drilling head has been moved away from the work after drilling of a row of holes, the plunger is brought clear of one of the pins, and during the movement of the fixture slide under the action

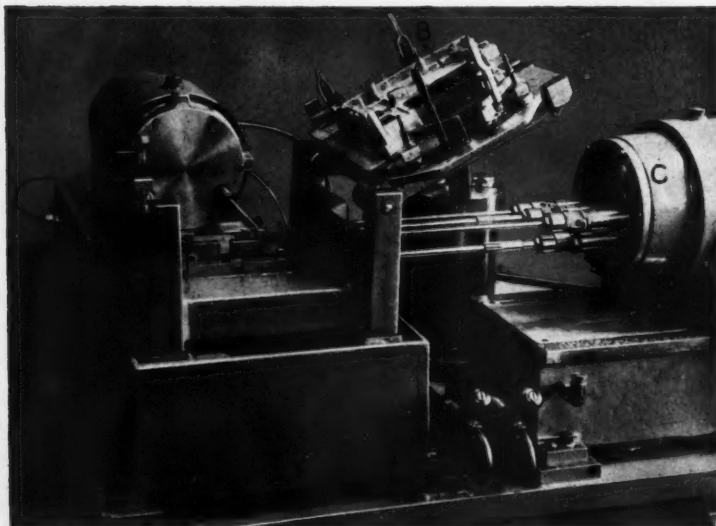
of the traversing cylinder, it is returned to its original position. Further movement of the slide brings the next pin into contact with the plunger, in readiness for drilling another row of holes. During the drilling operation, the pin is held in engagement with the plunger by air pressure.

A UNIT HEAD MACHINE FOR IN-LINE REAMING

Fig. 4 is a close-up view of a unit head machine which has been built by the company for in-line reaming holes in a magnesium component for a dictating machine. The component, indicated at B, is secured to the lower surface of the hinged cover for the fixture by hand-operated toggle clamps, and the cover is then swung to the closed position. The spindle head C, for one of the reaming units, has a working stroke of 9 in. on the base guideways, and is fitted with a 4-spindle gearless attachment. It provides for in-line reaming pairs of holes in fairly thin walls at opposite ends of the component. A 2-spindle gearless attachment is provided on the second unit head, which is secured to the base at right-angles to the first, and is employed for in-line reaming other holes in the workpiece.

SET-UPS ON S.P.K. BENCH-MOUNTED DRILLING MACHINES

In MACHINERY, 97/1088—9/11/60, reference was made to the company's latest bench-mounted drilling machine of the rising table type, which is



specially designed for operation in conjunction with their multi-spindle attachments. The 13-by 7-in. work-table has a vertical travel of 2 in., and an automatic cycle of rapid power traverse upwards, feed, and quick return is provided by an air-hydraulic system. Rapid approach, total

Fig. 4. Close-up view of a Slack & Parr unit head machine for in-line reaming holes in a magnesium frame component for a dictating machine



Fig. 5. This S.P.K. bench-mounted air-hydraulic machine is fitted with a Bristol-Erikson air-operated indexing unit and a multi-spindle head for drilling 25 holes in telephone ear and mouthpiece components

travel of the table, and feed, can be varied steplessly by separate knobs, and the cycle is started by a lever, or by two push-buttons which must be depressed simultaneously.

The machine is shown in Fig. 5 fitted with a Bristol-Erickson 6-station, air-operated indexing unit (Bristol Tool & Gauge Co., Ltd.) and a multi-spindle attachment, for drilling $\frac{1}{8}$ -in. diameter holes in ear and mouthpiece components for telephones. A hole is drilled at the centre of the component, and there are 8 equally spaced on a circle of $\frac{1}{2}$ in. diameter, and 16 on a circle of 1 in. diameter. All the holes are drilled in a cycle time of 8 sec., and the spindles are run at a speed of 1,420 r.p.m. A close-up view of the fixture which is fixed to the Bristol-Erickson unit is given in Fig. 6.

When a component has been loaded on to one of the work-holders on the fixture, both push-buttons at the front of the bed are pressed. The Bristol-Erickson unit is then indexed, and the table is moved upwards to perform the drilling operation. At the end of the upward travel, the table is rapidly returned to its starting position. Four sets of spindles are incorporated in the head, one of which, at the first working station, provides for drilling the central hole in the workpiece, and alternate holes in the outer ring. The spindles at the 2nd and 3rd working stations are employed

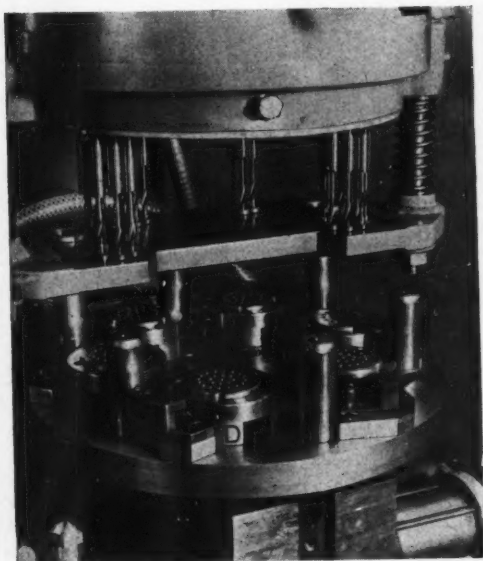


Fig. 6. Close-up view of the indexing fixture and the drilling head on the machine shown in Fig. 5

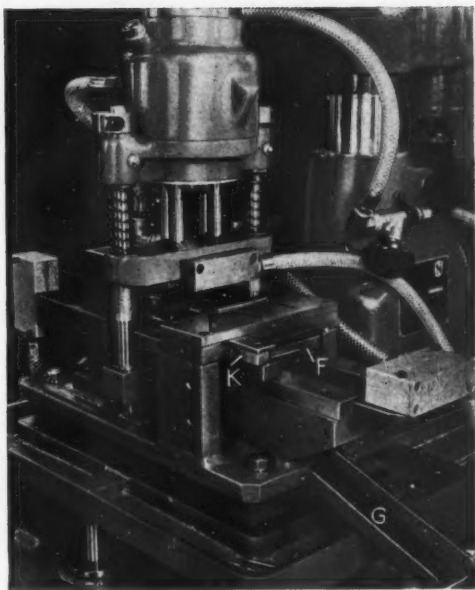


Fig. 7. This close-up view shows the fixture and gearless multi-spindle attachment mounted on another S.P.K. bench-type machine for drilling two 0.0465-in. diameter cross holes in each of two small-diameter spindle components. The machine operates on a fully-automatic continuous cycle

for drilling alternate holes in the inner ring, and those at the 4th station, for drilling the remaining holes in the outer ring. Six cylindrical pillars are mounted on the fixture, two of which enter bushes in the plate for the twist drill guide bushes during the upward movement of the table, to ensure accurate location of the workpieces. When drilling is in progress, the workpieces are held down by the bush plate, the latter being spring-loaded and attached to cylindrical guide bars which can slide in bores in the spindle head. When the fixture is being indexed, the components are prevented from moving on the holders by rubber pads attached to spring-loaded arms, one of which is indicated at D.

Fig 7 is a close-up view of another S.P.K. bench-mounted machine, fitted with a special work-holding fixture, and set up for operation on a fully-automatic continuous cycle, for drilling two 0.0465-in. diameter cross holes in each of two small-diameter spindle components for electric shavers.

Workpieces to be drilled, each of which has a reduced-diameter, threaded portion at one end, are

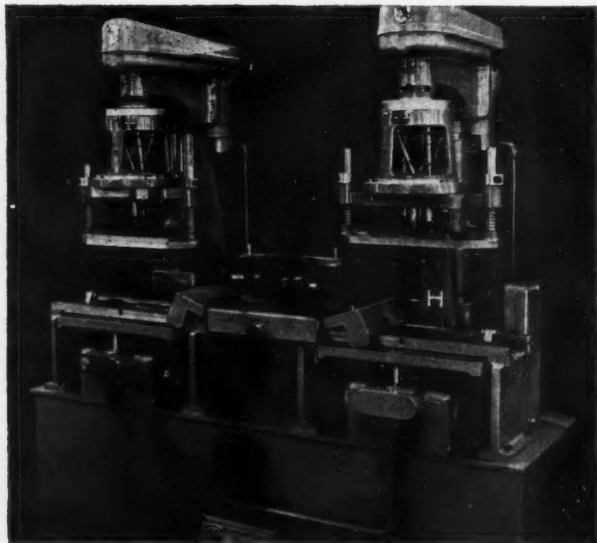


Fig. 8. Two S.P.K. machines are here shown mounted on a cabinet base and set up for drilling and tapping holes in a cylinder head for an air compressor. The right-hand machine has been modified to provide leadscrew control for tapping operations

stacked in profile slots in the top plate *E* of a "stationary" bridge-piece on the fixture. At the end of a drilling cycle, the work-table—and with it the fixture—is brought to the lowered position, as shown, and the slide *F* is traversed to the right by an air cylinder, on guideways on the base. During this movement, the drilled components are ejected from V-shaped slots in the slide *F*, by a wiper plate, and fall into the chute *G* down which they are discharged from the machine. At the same time, a shutter interposed between upper and lower top plates of the bridge-piece is moved transversely by the action of the cam *K*, and a pin attached to an extension piece on the slide. Two components now pass through openings in the shutter and the lower plate into the slots in the slide *F*. Next, the slide is returned to the drilling position, where it is located by a fixed stop, and at the beginning of this movement the shutter is returned to its original position by a spring. When the slide has been brought to the end of its travel, the parts to be drilled are held between the ends of the slots and a pair of spring-loaded plungers incorporated in a block at the left-hand end of the fixture. Downward force is exerted by a clamping piece attached to the spring-loaded casting for the twist drill guide bushes, when the work-table

is moved upwards for the drilling operation. The spindles in the gearless drilling attachment are run at a speed of 4,000 r.p.m.

The installation shown in Fig. 8 incorporates two S.P.K. machines mounted on a cabinet base and fitted with multi-spindle attachments, of the adjustable-centre type, for drilling and tapping holes in cylinder heads of different designs for air compressors, which are made in fairly small batches. The spindles can be readily set for centre distance with the aid of guide bushes for the drills and taps. These bushes are located in the pressure plates to suit the required pattern of holes in the workpiece.

Mounted above the work-tables of the machines is a pair of guide rails for the slide which carries the work-holding fixture. These guide rails are made in three parts, and the central portion is fixed to a pair of support pieces secured to the base between the machines. The outer portions of the guide rails are located by slots in these support pieces and in others at the ends of the base, and are connected to the tables of the machines

by pins. For loading and unloading workpieces, also for removing swarf from the holes in the component following the drilling operation, the fixture slide is moved on to the central portion of the guide rails as shown. The slide is then moved to the left or right, depending upon the operation to be carried out, and is located in the machining position by a plunger which enters a hole in the front guide rail. During the upward movement of the table for the drilling or tapping operation, the outer portion of the guide rails is raised clear of the slots in the support pieces, and guide pins on the fixture enter bushes in the pressure plate, to ensure accurate location of the work in relation to the cutter spindles.

Drilling is carried out by the left-hand machine which is of standard design, and the working cycle is started by a lever. The right-hand machine has been modified to provide lead-screw control for tapping operations. To this end, the hydraulic dashpot arrangement normally provided to give the cutting feed, also the lever for starting the cycle, and the knobs for varying the feed and rapid traverse movements of the table, have been removed. A bracket, as at *H*, is attached at its lower end to the rear of the table, and incorporates a nut at the upper end, which engages with a

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leadscrew driven from the multi-spindle attachment.

The tapping cycle is initiated by depression of a push-button, which starts the spindle-driving motor, and upward movement is imparted to the table by the action between the leadscrew and nut. At the same time, compressed air at controlled pressure is delivered to the table-traversing cylinder housed in the bed, which serves to counterbalance the table, the outer portion of the guide rails, and the work-holding fixture. When the table has been brought to the end of the tapping stroke, the spindle-driving motor is reversed by a micro-switch.

Sciakydyne Zero-error Motor Control System

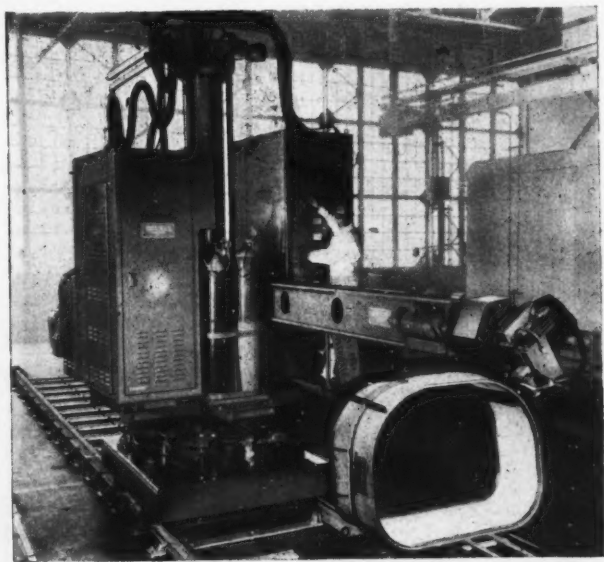
Sciaky Bros., Inc., Chicago 38, Ill., U.S.A., have introduced the Sciakydyne Zero-error motor control system which provides a direct link between an a.c. power source and a d.c. motor, and, it is stated, may be regarded the electronic counterpart of a rotating amplifier.

The system, which has the advantage of being static, includes an additional feed-back loop which makes an absolute comparison between input and output, and enables complete equality between the

two values to be achieved. Through this additional loop, moreover, flat regulation at any speed is obtained, as well as compensation for temperature and component variation. The control dials are, therefore, calibrated directly in rational units, for example, r.p.m. or in. per min., and they are automatically maintained in calibration. The normal speed range is 100 to 1, but equipment with a 300 to 1 range has been produced. The system has a very high speed of response, and it is stated that the armature current can be reversed within half a cycle, or 8 milli-sec.

It is claimed that the Sciakydyne system combines the reliability of the 2-phase servo with the speed of response, power, and torque stiffness of a hydraulic servo, and has higher efficiency. Motors up to 100 h.p. can be controlled by the system, and where applicable it is used throughout in Sciaky welding equipment. An example of such an application is afforded by an integral boom and manipulator fusion welder supplied to the North American Aviation Inc., as shown in the accompanying figure. The Sciakydyne system is employed for arc space regulation, and as a speed control for boom elevation, boom traverse, base traverse, and head rotation. The workpiece assembly shown in the illustration is an experimental duct, which is fabricated from stainless-steel honeycomb material.

Sciaky Bros. Inc., are associated in this country with Sciaky Electric Welding Machines, Ltd., Falmouth



Sciaky integral boom and manipulator fusion welder provided with Sciakydyne Zero-error motor control

NEW DESIGN OF SHEET METAL FASTENING. Mr. A. A. Oakes, a graduate student of the Philadelphia Museum College, Penn., U.S.A., was among the winners of Alcoa Student Design Merit Awards for 1961. This award was made for a fastening arrangement that is described as a "sheet metal zipper."

Flanges of suitable form are provided on the edges of aluminium sheets, and a joint is made by sliding a piece of polyethylene or aluminium tubing, which has been slit longitudinally, over these flanges. No tools are required. It is stated that the polyethylene tube can be readily stripped from a joint when it is required to break down a temporary structure, whereas a more permanent connection is provided when the aluminium tubing is employed.

NEW PRODUCTION EQUIPMENT

Edited by

G. W. Mason

and

A. J. Barker

Noble & Lund Heavy-duty Plano Milling Machine

Built recently by Noble & Lund, Ltd., Gateshead, 10, the heavy-duty plano milling machine shown in the figure has a capacity for work up to 7 ft. wide by 6 ft. high, and the 15-ft. by 6-ft. T-slotted work-table, which is a deep, well-ribbed, box-section casting, has a maximum travel of 15 ft. on broad rectangular-section bed-ways. The length of the bed-ways is such that the table is fully supported at the extreme ends of its travel.

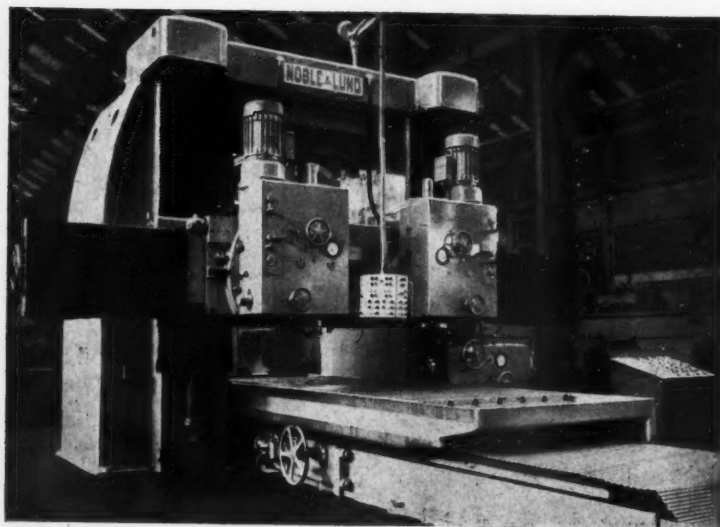
Two milling heads are mounted on the cross-rail, and a side head on the right-hand column, and each is driven by a 30-h.p. flange-mounted motor, through a gearbox and spur reduction gearing. The 16 spindle speeds provided range from 10 to 502 r.p.m. Totally-enclosed gears for the spindle drive are automatically lubricated by a pump built

into the head, and the shafts on which they are mounted run in ball and roller bearings. An ammeter is provided on each head to indicate the load on the driving motor, and push-buttons are provided for "inching" the cutter spindle to facilitate gear changing.

Made from alloy steel and precision ground, the cutter spindle runs in taper roller bearings, and the nose end conforms to the requirements of B.S.1660:1953. The spindle has an axial adjustment of 15 in. by hand for setting the depth of cut, and a circular T-slot is machined in the end face of the 11½-in. diameter flanged quill, to enable attachments to be mounted. A fine feed motion is provided, which enables the spindle to be advanced under push-button control by a pre-set amount in the range from 0.005 to 0.024 in., for applying a finishing cut, when a roughing cut has been completed on the work. When the push-button has

been pressed, the following automatic sequence takes place:—A clamping arrangement is released, the spindle is advanced by the pre-set amount, and the clamp is tightened. In addition, rapid power traverse can be applied to the spindle under the control of a push-button.

Both cutter heads on the cross-rail can be swivelled through 20 deg. on each side of the vertical position, for milling inclined surfaces, and they can be traversed simultaneously or independently. A minimum centre-distance of 31½ in. is obtainable between the cutter spindles. These heads have long bearing surfaces, and gibs permit adjustment for align-



This Noble & Lund heavy-duty plano milling machine has a capacity for handling workpieces up to 7 ft. wide by 6 ft. high, and the maximum table stroke is 15 ft.

ment. The length of the cross-rail is such that when one milling head has been moved clear a cut can be taken by the other head on workpieces up to the maximum width that can be handled on the machine. The side head is counterbalanced by a weight housed in the column, and the maximum distance obtainable between the centre line of the cutter spindle and the table is 64 in. Clamps for securing the side milling head to the column ways and the other heads to the cross-rail are tightened and released by means of push-buttons. Optical measuring equipment is provided for the heads.

Eighteen feeds from 0.4 to 30 in. per min. are provided for the table; and the side and cross-rail milling heads, drive being taken from a 10-h.p. motor, through a gearbox housed in the right-hand column. From the gearbox, drive is transmitted by a hardened steel worm in mesh with a cast iron worm-type rack bolted to the table. Ball thrust bearings are provided for the worm shaft, and the feed gears are lubricated by a built-in pump. For rapid power traverse there is a separate 20-h.p. motor, which can be brought into use by means of a push-button without the need for disengaging the feed. As soon as the push-button is released, rapid traverse is disengaged, and feed is again applied. This arrangement permits of quickly positioning the work in relation to the cutter when small, widely-spaced, surfaces are to be milled, for example, on bedplate components.

The side and cross-rail milling heads can be adjusted by hand, and feed and rapid traverse movements are transmitted by way of electro-magnetic clutches. Hand-wheels are mounted on both sides of the bed for traversing the table, and are interlocked with the feed and rapid traverse motions to prevent simultaneous engagement.

The cross-rail is of considerable depth, and is bow-shaped at the rear to ensure the necessary strength to prevent deflection when heavy milling cuts are being taken on the work. It is adjusted in a vertical direction by a pair of screws, positioned in front of the column ways to reduce the risk of tilting, and driven by reduction gearing from a 15-h.p. motor, mounted on the cross bracing member at the tops of the columns. Quick-acting, push-button operated, power clamps secure the cross-rail in the required position on the column. Bellows-type guards are provided for the cross-rail and column ways, and covers, of roller shutter type, for the

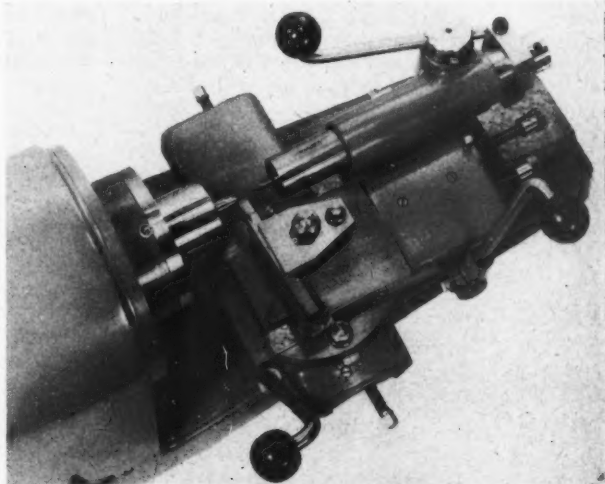
bed-ways, are attached to the ends of the table. Coolant from a reservoir in the bed is delivered to the milling cutters by a motor-driven pump through flexible hoses.

Duplicate sets of push-buttons for controlling the various driving motors on the machine are built into a pendant-type panel and a floor-mounted console, and a comprehensive system of interlocks is incorporated. For example, there is a pressure switch which prevents traverse motion being imparted to the table until the company's patent Fluilink system, which provides for automatic lubrication of the bed-ways, has been brought into operation. Similarly, table feed cannot be engaged until the spindle driving motor on one of the milling heads has been started.

The machine weighs approximately 82 tons, and occupies a floor space of 38 ft. by 24 ft.

Stopp Type EPM11 Finishing and Second-operation Lathe

In the figure is shown the type EPM11 finishing and second-operation lathe made by Dr. Ing. Robert Stopp, Weinheim/Bergstrasse, West Germany, for whom the sole agents in this country are F. J. Robotham & Co., Ltd., 71 Lascelles Road, Slough, Bucks. It has a centre height of 3½ in., and with a normal-length bed, the distance between centres is 6 in. If required, a longer bed can be provided to give a maximum length capacity of 13 in.



Stopp type EPM11 second-operation lathe

The bed is cast integral with the headstock, and the latter incorporates a built-in motor which is coupled directly to the work-spindle. A single-, 2-, or 3-speed motor can be provided, the latter being of 0.25/0.35 h.p. with normal speeds of 670, 1,300, and 2,800 r.p.m. If desired, however, the low speed may be 930 r.p.m. The spindle, which is bored 25 mm. (0.984 in.), is mounted in heavy-duty sealed ball bearings and can be supplied to take either draw-in or push-type collets. A maximum diameter of $\frac{1}{4}$ in. is accommodated in the standard collets, but step collets up to 1 in. diameter by $\frac{1}{8}$ in. depth capacity can be supplied, also enlarged-head collets up to 2 in. diameter by $\frac{3}{8}$ in. depth capacity. Closing pressure is applied to the collet by adjustable disc springs which are retracted by means of a foot lever, and this lever also controls the starting and stopping of the spindle motor, and the application of a brake. An adapter can be provided to take step chucks with diameter capacities up to 3 in.

Of the hand-lever and rack operated type, the compound swivelling cross-slide has a cross travel of $3\frac{1}{2}$ in., a longitudinal travel of $2\frac{1}{2}$ in., and a swivel adjustment of 45 deg. to the right and left. Adjustable screw stops are provided for both directions of travel. If desired, an adapter plate can be fitted which is provided with T-slots to enable a rear tool-holder to be mounted. A plain, lever-operated, cut-off slide, with a travel of $3\frac{1}{2}$ in., to take front and rear tool-holders, is also available.

The lathe can be supplied with a lever-operated tailstock with a quill travel of $2\frac{1}{2}$ in., which can be arranged to take collets up to $\frac{1}{2}$ in. or $\frac{3}{8}$ in. diameter, or a No. 1 or a No. 2 Morse taper centre. Another type of tailstock which can be fitted is handwheel operated, and has either a No. 1 or a

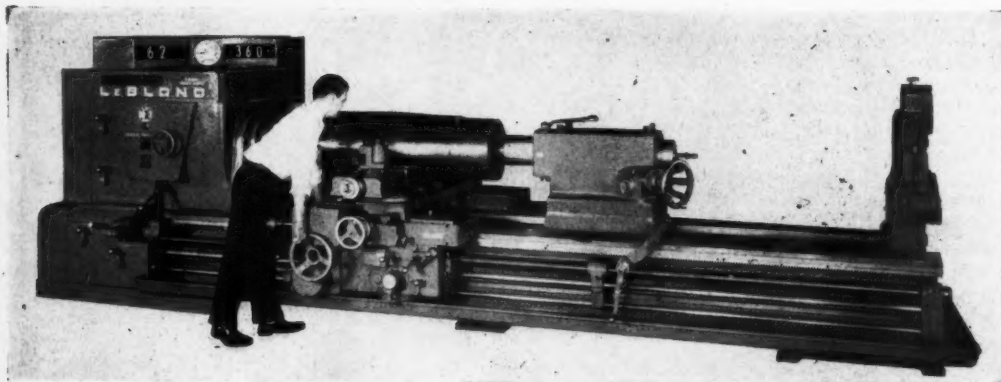
No. 2 Morse taper. If required, the tailstock can be replaced by an indexing turret tool slide.

As an alternative to bench mounting, the lathe may be supported on a welded-steel base which may incorporate a coolant system. A bracket can be supplied which enables the lathe to be mounted with the spindle in the vertical position. Other equipment available includes an electrically-controlled spindle reversing unit for threading operations. There is also a type EPM111 lathe, with similar features, the spindle of which will take draw-in collets up to 1-in. capacity. Step chucks with diameter capacities up to 4 in. can be employed with the aid of an adapter. Other adapters are available for both lathes to take expanding mandrels, drill chucks and 3-jaw chucks.

LeBlond Servo-Shift Speed Selection System

With the Servo-Shift speed selection system for lathes, which has been developed by the R.K. LeBlond Machine Tool Co., Cincinnati, Ohio, U.S.A., a dial mounted on the headstock is set manually in accordance with the cutting speed required and the workpiece diameter. A button is then pressed, with the result that gearing to provide the appropriate spindle speed is engaged automatically. Provision is also made for selecting spindle speeds directly, and the dial can be re-set while turning is in progress, to enable a fresh speed to be obtained with a minimum of delay, before taking a further cut at a different diameter.

If required, an additional set of controls for the system can be provided on the apron, to avoid the delays which may occur when frequent speed changes are necessary, particularly on long-bed



This LeBlond heavy-duty lathe is equipped with the new Servo-Shift speed selection system

machines. When this arrangement is employed, an illuminated digital display unit can be mounted on top of the headstock, as shown in the figure, to indicate the cutting and spindle speeds in use.

The system is at present incorporated in the company's type NK machines, and will shortly be available for other heavy-duty lathes in their range. Wickman, Ltd., Fletchamstead Highway, Coventry, are the British agents for the R.K. LeBlond Machine Tool Co.

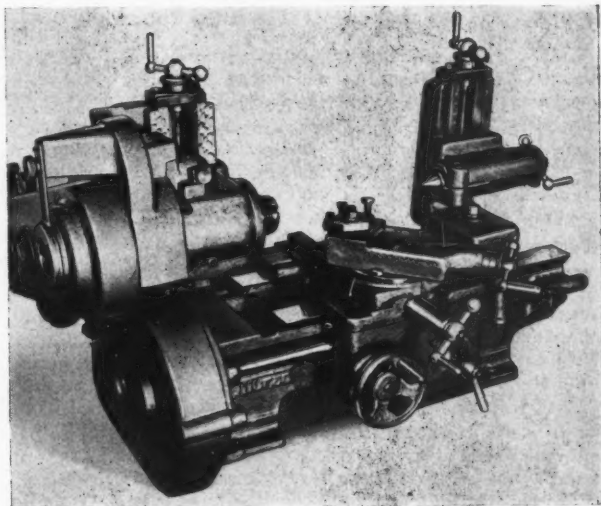
Murad Bormilathe Universal Machine

The provisionally patented Bormilathe universal machine shown in the illustration has been introduced by Murad Developments, Ltd., Queenborough, Isle of Sheppey. Intended for bench mounting, this machine can be readily set up for turning, screw-cutting, boring and milling metal parts, also for performing a variety of woodworking operations, including turning, sawing, grooving, combing, tenoning, spindle moulding, and sanding.

Both the spindle housing and the housing for the tailstock barrel can be adjusted in the vertical direction on dovetail guideways, over a distance of $3\frac{1}{2}$ in., to provide a maximum swing capacity over the bed-ways of 14 in. diameter, and the tailstock column can be set over on the base for taper turning. The 6-in. wide bed has an overall length of 22 in., and a maximum of 10 in. is admitted between the headstock and tailstock centres. Close-grained iron castings, of box-section, which form the headstock and tailstock columns, are bolted and keyed to the rear of the cast iron bed.

Bored $\frac{3}{8}$ in. diameter, the spindle will take a No. 3 Morse taper shank, and runs in pre-loaded angular contact ball bearings. It is threaded 1 in. diameter by 8 t.p.i. at the nose end, and drive is taken by a belt and stepped pulleys from a Bronson $\frac{1}{2}$ -h.p. geared motor unit. Different speed ratios can be obtained by transposing pick-off gears between the motor shaft and the output shaft of the Bronson unit, to give spindle speeds ranging from 132 to 1,750, 66 to 875, or 14 to 583 r.p.m. The gearbox assembly can be swivelled on the end of the motor for adjusting the driving belt for tension.

From the spindle, drive to the $\frac{1}{2}$ -in. diameter by 8 t.p.i. Acme leadscrew is taken by pick-off gears, which enable screw threads from 4 to 40



Murad Bormilathe universal machine for turning, boring and milling operations

per in. to be cut. A sliding feed of 0.006 in. per spindle rev. is provided for turning operations. The leadscrew nut is mounted in dovetail guideways, and can be adjusted to compensate for wear. Micrometer drums are provided for the traversing screws for the cross-slide and the swivel top slide, also for the screws for adjusting the spindle housing and the tailstock barrel housing on the column ways.

A 7- by 8-in. T-slotted table can be mounted on the saddle in place of the cross-slide assembly, when boring and milling operations are to be carried out. The table has a cross travel of 5 in., and the distance between the working surface and the top face of the bed is 2 in. A 1-in. diameter arbor to take cutters for horizontal milling can be supplied. This arbor is fitted with keys at one end which engage with transverse slots in the end face of the spindle nose for transmitting the drive. The other end of the arbor is fitted with a bearing, and, when milling is in progress, it is supported by the tailstock barrel, the latter being bored No. 3 Morse taper. End mills, face milling cutters, and cutters for milling keyways, as well as boring tools, can be mounted in the spindle nose.

Other equipment available includes a 10-in. diameter faceplate, 4- and 6-in. diameter backplates for chucks, a rotating centre, V-blocks and angle plates for mounting on the work-table, and a saw bench and a combing fixture.

Arboga UM 400 Universal Machine Tool

On the Swedish-built Arboga UM 400 universal machine tool, which is marketed in this country by Kavanagh O'Moore & Co., Ltd., 1a Aldred Road, London, N.W.6, a self-contained, totally-enclosed spindle unit is employed, which incorporates a 2-speed, 0.25/0.15-h.p. motor. Four speeds from 365 to 2,800 r.p.m. can be obtained for the spindle, which has a No. 1 Morse taper bore in the nose. A cylindrical portion enables the unit readily to be clamped in various positions, and with this arrangement, there is no need to alter the transmission arrangements when changing the set-up to provide for a different machining operation.

For vertical milling, the unit is mounted at the outer end of a horizontal cylindrical bar, which is held in a clamp attached to the top of the column of the machine, as shown in Fig. 1, and the maximum throat depth is 3½ in. The column, which is adjustable vertically, and the bar can both be swivelled about their axes, by reference to graduated scales, and when the spindle unit is set in the vertical position, a maximum distance of 9 in. is obtainable between the nose and the T-slotted sur-

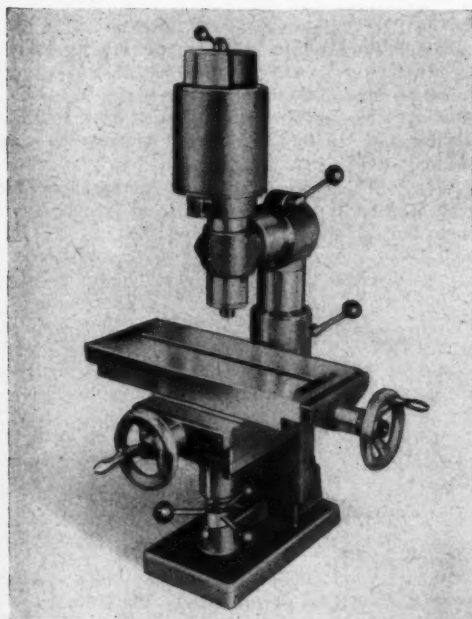


Fig. 1. The Arboga UM 400 universal machine is here shown set up for vertical milling

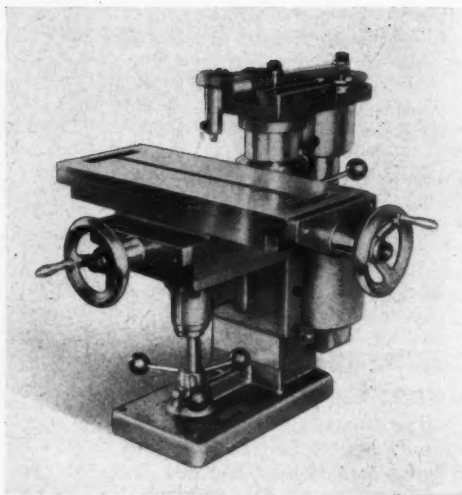


Fig. 2. The Arboga universal machine is here arranged for shaping, with the spindle unit suspended in an inverted position at the rear

face of the work-table. The latter measures 14 by 5½ in., and has longitudinal, lateral, and vertical traverses of 5½, 2, and 3½ in., respectively, by means of hand-wheels which are provided with graduated drums. For drilling, the unit is mounted in a similar position, but the arrangement is such that the spindle can be traversed axially for a distance of 1½ in. by means of a lever.

When slotting is to be performed, the spindle unit is mounted at the rear of an attachment that is secured to the end of a lateral bar carried by the column, and drive to the tool-holder slide, which has a stroke length of 2½ in., is taken through an eccentric pin and a connecting link. For shaping, an attachment of similar design is mounted directly at the top of the column, as seen in Fig. 2, the spindle unit thus being suspended in an inverted position at the rear, and the maximum distance obtainable between the axis of the cylindrical tool-holder bar and the work-table is 5½ in.

To permit horizontal milling operations to be carried out, the spindle unit is mounted in the lower portion of a double clamp, which is secured to the column. The upper part of this clamp provides for the attachment of an overarm and bracket, to support the outer end of the ½-in. diameter arbor that is normally supplied. For surface grinding, the unit is mounted in a similar position, and a guard is employed which permits the use of wheels up to 4 in. diameter.

When the machine is set up as a lathe, the spindle unit is arranged longitudinally, and is attached by means of a double clamp to the left-hand end of a similarly-disposed bar, which is carried by the column. Diameters up to 1½ in. can be swung, and a tailstock unit, which is also mounted on the bar, may be adjusted to provide a maximum distance of 5½ in. between centres. Cutting tools are clamped in a square holder, which is secured to the work-table.

Redin No. 20 Gear De-burring Machine

Marketed in this country by Mortimer Machine Tool Co., Ltd., Mortimer House, Acton Lane, London, N.W.10, the American-built Redin No. 20 machine, here shown, is intended for de-burring external and internal gears with pitch diameters ranging from 0 to 20 and 1½ to 16 in. respectively, down to 16 d.p. and with face widths up to 6 in., also other basically circular components with a wide variety of profile shapes, including splines. A No. 36 machine, of larger capacity, is also available.

The machine is designed for operation on a semi-automatic cycle, and the work is carried at the upper end of a vertical spindle. After the work has been loaded, a push-button is pressed, whereupon a cover, pivoted at the rear, is lowered to enclose the working area. At the same time, the

grinding wheel, mounted on the spindle of an air-operated head, which is arranged laterally inside the cover, is brought into contact with the periphery of the work. Simultaneously, drive is engaged to rotate the work at a pre-determined speed between 1 and 10 r.p.m., and compressed air is supplied to the grinding head, to drive the spindle at a speed of 11,000 r.p.m. The spindle is arranged to "float", with the result that the profile of the work is followed automatically during the progress of de-burring, without the need for a formed wheel or the use of templates or gearing. After a pre-set period has elapsed, the cover is returned to the open position, and the grinding and work spindles are stopped.

To allow for setting to suit the face width and diameter of the workpiece, vertical adjustment is provided and the grinding head is carried on a horizontal screw. Grinding wheels up to 4 in. diameter by ½ in. wide can be mounted on the spindle. If required, an additional head can be provided for de-burring the under-side of a gear simultaneously. This head can be adjusted independently, and when it is not needed, is rendered inoperative by means of a selector switch. The machine is arranged for connection to dust extraction equipment, and occupies a floor area of 3 ft. 11 in. by 3 ft. 4 in.



Redin No. 20 gear de-burring machine

A NEW WIRE GALVANISING PROCESS has been introduced into this country by AEI-Birlec, Ltd., Tyburn Road, Erdington, Birmingham, 24. Originally developed in France, this process, it is claimed, offers both economic and technical advantages, as compared with the conventional sequence of annealing, pickling, fluxing, and dipping.

With the new method, annealing is carried out in such a manner that the pickling stage is not required, the wire being passed directly into the zinc bath at the correct temperature. The heat input necessary to maintain the temperature of the bath is thus considerably reduced. Apart from the savings that result from simplification of the process, it is stated that much higher wire running speeds can be employed. Greater production can thus be obtained from a given floor space.

It is also claimed that a zinc coating of improved quality is obtained, the intermediate layer of zinc-iron alloy being virtually eliminated. Treated wire can be subjected to re-drawing and other severe working without flaking, and both the hardness of the wire and the coating thickness can be controlled to meet a range of specifications.

A plant for galvanising by this process, which is now under construction, will have a capacity of about 1½ tons per hour.

Machine Shop Patents

AUTOMATIC LOADING UNIT FOR A CENTRELESS GRINDING MACHINE

The figure shows a side elevation of an electro-hydraulically operated unit, for automatically transferring ring-shaped workpieces to and from the working area on a centreless machine, arranged for plunge-grinding.

Blanks are supplied by way of the chute A, which is inclined downwards and has a stop at the lower end, and the completed workpieces are discharged down a second chute B. Parts are successively transferred to and from the working position, where they are supported on two shoes C, by means of the arms D and E, respectively. Secured to shafts mounted in the housing F, these arms are operated in unison, and are arranged to swing in separate parallel planes, to prevent mutual interference.

During the progress of grinding, the arms are swung to the positions shown, and the shafts on which they are mounted are then moved axially, to insert cylindrical carriers into the bores of the lowermost blank on the supply chute and the part that is being ground. After grinding has been completed, the wheel-head is retracted, and operates a limit switch to cause the arms to be swung in opposite directions, to deliver fresh and

completed parts to the working position and the discharge chute, respectively. During these movements, the parts slide across a backing plate, and are thereby retained on the carriers. Motion is imparted to the arms through gearing and a common rack, which is mounted between guide rollers in the housing and is traversed by means of a crank. With this arrangement, the speed at which the arms are swung is reduced gradually as they approach the ends of their movements, to avoid shock. Next, the arm shafts are again moved axially, to withdraw the carriers from the parts, and the arms are subsequently returned to the original positions, in readiness for the next cycle.

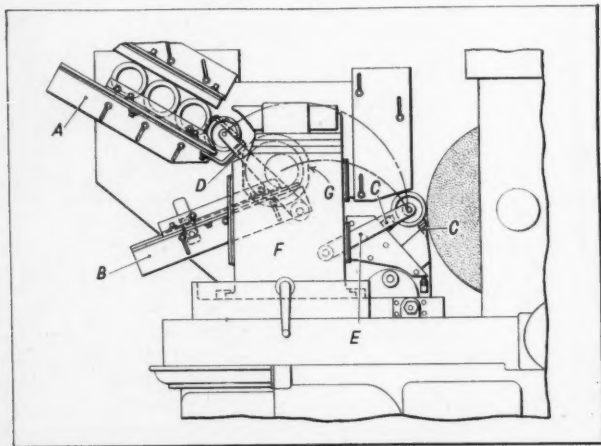
Shortly before completion of a loading movement, a cam-operated limit switch is actuated to initiate traverse of the wheel-head of the machine towards the support shoes for the work, in preparation for grinding. Simultaneously, a magnetic chuck mounted at the nose of the work-head spindle (arranged at the rear of the working position, as viewed in the figure) is energized, to provide for driving the work during grinding, also the de-magnetizer G, which serves to hold the finished part at the top of the discharge chute when the carrier is withdrawn.

At an early stage during grinding, the de-magnetizer is de-energized to permit the completed part to roll down the discharge chute, and the electrical supply to the magnetic chuck is reversed when the wheel-head is retracted, to release the workpiece in readiness for unloading.

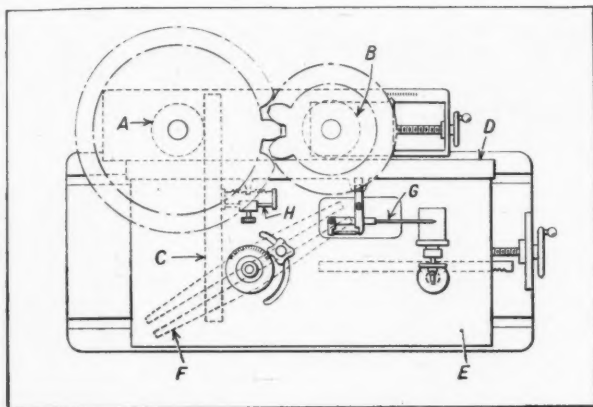
871,270. The Cincinnati Milling Machine Co., Cincinnati, Ohio, U.S.A. [Application date in the U.S.A. November 14, 1958. Published June 21, 1961.]

ROLLING GEAR TESTER

A plan view is shown in the accompanying figure of a rolling gear tester, of the type whereby errors on either or both of two meshing gears are detected by variation of the rate at which angular velocity is transmitted, and the arrangement is such that the diameters of the base circle discs em-



Side elevation of a unit for automatically loading and unloading workpieces on a centreless grinding machine



Base circle discs for use on the rolling gear tester here shown in plan need not be made with high accuracy

employed are not related to the dimensions of the gears under inspection. In this way, the need for making discs with high accuracy is avoided.

The gears are carried at the upper ends of two vertical shafts, one of which is mounted in bearings in the bed of the unit. The second shaft runs in bearings in a longitudinal slide, which may be adjusted for setting the centre distance. Base circle discs A and B attached close to the lower ends of the non-adjustable and the adjustable shafts are held in contact with separate straight-edges C and D, which are carried in roller ways on the bed and are arranged laterally and longitudinally, respectively.

During testing, the slide E is traversed on longitudinal bed-ways, and serves to move the straight-edge C, on the upper face of which there is a vertical pin that engages a groove in the underside of the inclined bar F clamped to the slide. In this way, the associated shaft is turned, and motion is transmitted through the gears and the base circle disc B to the straight-edge D. During setting of the unit, the bar F is adjusted to such an angle with respect to the direction of traverse that when there are no tooth errors on either of the gears, the straight-edge D is moved at the same rate as the slide E. When an error is present, however, relative motion occurs between these two members, due to alteration of the angular velocity transmitted between the gears, and causes deviation of the recorder pen G, which is pivotally mounted on the slide and operated by a pivoted lever that is engaged between two lugs on the straight-edge. Also mounted on the slide, the recorder drum associated with this pen is rotated

by means of friction discs and a pinion which engages a rack secured to the bed.

By means of tension springs, which are attached to both sides of another lug on the straight-edge D, and anchored to an adjustable carrier H, clamped to the slide, the system may be urged in either direction, for checking both sets of tooth flanks successively.

869,771. Maag Gear Wheel & Machine Co., Ltd., 219 Hardstrasse, Zurich, Switzerland. [Application date in Switzerland April 23, 1958. Published June 7, 1961.]

HIGH TEMPERATURE ARC. The plasma thermometry laboratory of the U.S. National Bureau of Standards has developed an improved wall-stabilized, high-current density arc equipment, to provide a basic source of high temperature radiation, which is pure and stable. A feature of this equipment, which provides temperatures within the range from 10,000 to 20,000 deg. absolute, is that the electrodes are surrounded by an inert gas such as argon.

The gas to be studied is introduced in the central region, the argon serving to isolate it from the electrodes. As a result, a large number of gases, including oxygen and nitrogen, can be maintained at temperatures of the order of 15,000 deg. absolute, without electrode contamination. Moreover, the gases are introduced and exhausted in such a manner that it is possible to maintain the centre of the arc completely free from the buffer gas (argon).

PERSONS PER CAR IN EUROPEAN COUNTRIES.—According to figures published in the July issue of the *EFTA Bulletin*, the number of persons per car in the EFTA and E.E.C. countries in 1959 ranged from 7 in Sweden to 63 (estimated) in Portugal. France had the second lowest number (9), followed by the United Kingdom and Luxembourg (10), Switzerland (12), Belgium and Denmark (13), West Germany (15), Norway (19), Austria (21), Netherlands (25), and Italy (30). By comparison it may be noted that in 1950 the numbers ranged from 21 in the United Kingdom to 137 in Italy. In that year France again had the second lowest number (27), followed by Sweden (28), Luxembourg (30), Switzerland (32), Belgium (35), Denmark (36), Norway (50), Netherlands (72), and West Germany (78).

Quick-change Press Lines for Producing Electrical Control Equipment

IN A PERIOD OF LESS THAN 20 years, the yearly output of electrical power distribution and control equipment by the Federal Pacific Electric Co., Newark, N.J., U.S.A., has risen in value from 1.5 to more than 100 million dollars. Successful operation in this competitive field necessitates efficient use of manufacturing equipment, and the company has developed some interesting practices, particularly in connection with presses.

Enclosures for switches, fuses, circuit breakers, and other electrical control equipment are important items. These sheet metal housings may require as many as 30 press operations, and are made by the company on a monthly production schedule. Quantities vary greatly, and are determined on the basis of stores inventories, and from sales forecasting.

When required in sufficient numbers, enclosure parts are made in progressive dies on large, heavy-

duty, presses. In Fig. 1, a 1,000-ton Verson, eccentric-type, straight-sided press is shown set up for stamping covers for the company's Stab-lok circuit-breaker enclosures from 16-gauge coiled material. The latter is advanced by means of a mechanically-driven slide feed which operates in conjunction with a stock oiler and an automatic coil cradle.

Wherever possible, similar enclosures are employed for various applications. Many designs are standardized, in part, and the combined total production may then warrant the expense of making a progressive die for at least a number of the primary operations. Different secondary operations are subsequently performed on batches of the parts, using single dies.

In cases where the use of progressive dies is not feasible but production is relatively high and multiple operations are required, the company has developed a "quick-change press line" technique as seen in Fig. 2. These press lines are formed by rearranging presses according to the operations to be performed on a part. For this purpose some special plant layout facilities have been provided.

The department in which sheet-metal enclosures are made is equipped with 52 presses, the majority of which are in the 45- to 100-ton capacity range. These presses can readily be moved from one position to another by overhead travelling cranes that serve the entire area. In Fig. 3, an overhead crane is seen being used to move one of these presses to a different position. The presses, it may be noted, are not generally fastened down.

Air and electric power connections are available throughout the department, to enable the presses to be located as required. Electrical points are provided by a plug-in bus-bar system, which is a product of the company. The air lines and bus-bars are either supported overhead as may be seen in Fig. 3, or run through an under-floor trench system, as shown in

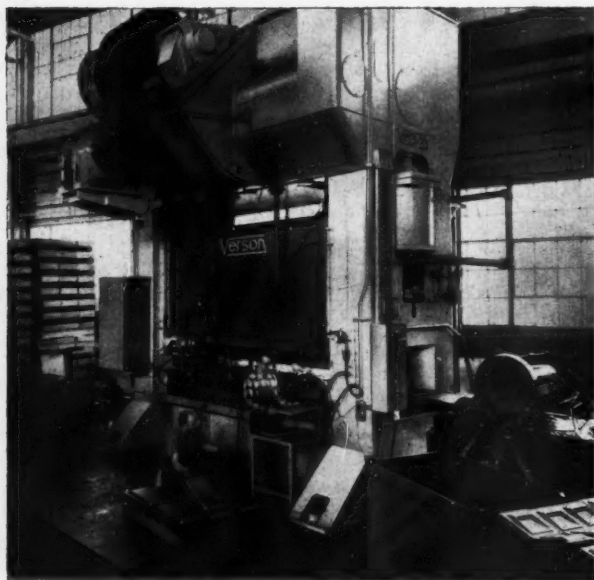


Fig. 1. Verson 1,000-ton mechanical press set up with progressive tools for producing sheet-metal enclosures for electrical control equipment

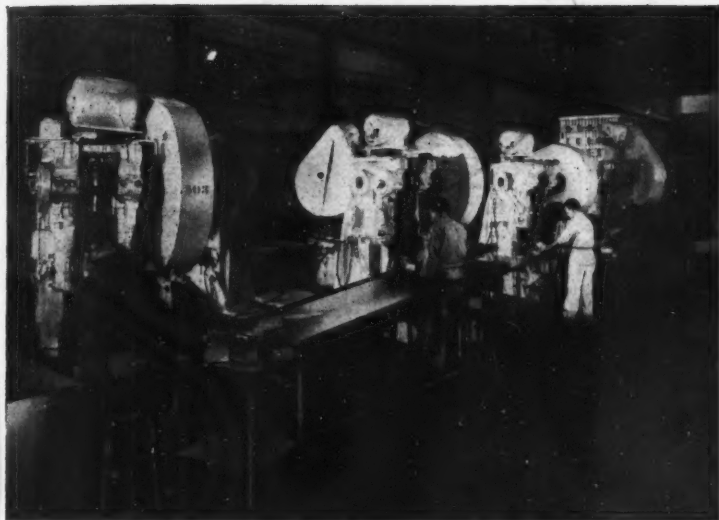


Fig. 2. An example of a "quick-change" line incorporating four presses

Fig. 4. With the latter arrangement, removable cast iron covers provide access to connection points.

It has been found that these quick-change temporary lines are effective when a series of operations is required to be performed on three or four presses and production quantities per run are between 5,000 and 20,000 pieces. When quantities are of the order of 15,000 to 20,000 pieces, however, the advisability of using a progressive die is carefully investigated.

The basic advantages of the method are improved output rates and the avoidance of intermediate storage problems. Materials handling is an important consideration in this particular plant because of the volume of production, and the bulky nature of many of the parts. Metal chutes placed between the presses enable the parts to be passed from one machine to the next at die level, and unnecessary work handling and inconvenience to the operators are thus eliminated.

A group incentive payment scheme devised by the company has proved particularly advantageous in connection with these press lines. After the first few pieces of a batch have been produced by the setter, and accepted by the inspection department, the press line is handed over to the team of operators. During the run, hourly checks are made of the size of the part, to determine if the die is sufficiently sharp to continue in use. Often, with press line work, some operations can be performed at much faster rates than others. In such

instances to ensure economy, and a smooth flow of work, fewer operators are employed, and they move from press to press, as required. When a production run has been completed, the last part made is compared with the first, to ascertain the final condition of the die.

The temporary press line seen in Fig. 2 provides for four secondary single-die operations on a switch box made from 16-gauge cold-rolled steel. Initial operations are carried out in a progressive-die, set up on a 300-ton Verson press. Coil material, 8½ in. wide, is fed to the die, which progressively

notches four corners, punches eight ¼-in. diameter holes, punches and embosses key holes and mount-

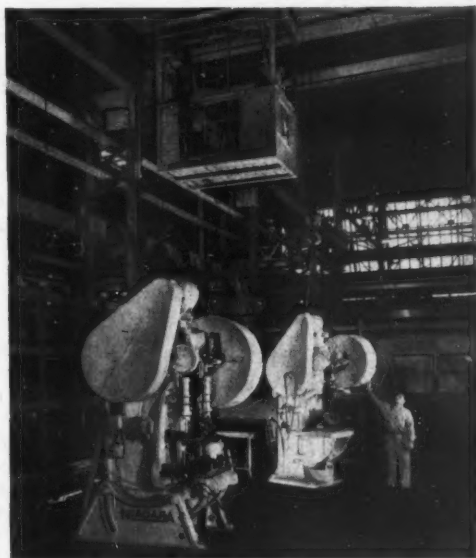


Fig. 3. Moving a press by means of an overhead travelling crane, to a new position in a production line

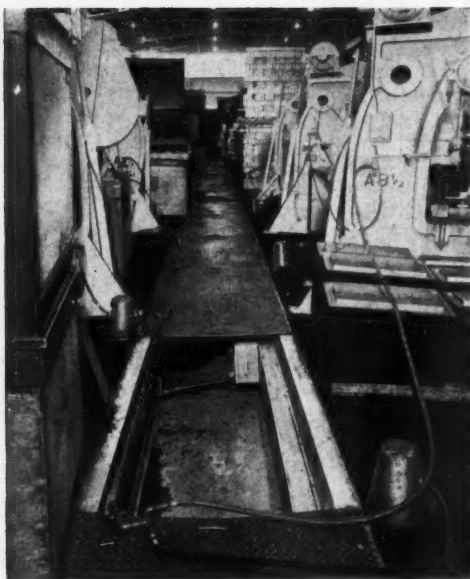


Fig. 4. View of the under-floor trench system which houses compressed air lines and plug-in bus-bar points for the electrical power supply

ing holes, and, at the final stage of the tool, flattens, cuts off, and forms each component.

For the secondary operations, the first press in the temporary line is set up to pierce four holes of 0.265 in. diameter, and produce two plunged holes which are subsequently tapped No. 10-32. The die in the second press punches one hole, and the die in the third press, the cover catch holes and two $\frac{1}{8}$ -in. diameter holes. At the final operation, two hinge slots are pierced.

AUTOMATIC CLEANING, PHOSPHATE-COATING AND PAINTING LINE

After the various enclosure components have been spot welded together, they pass, together with certain products from other departments of the company, to a continuously-operating automatic cleaning, phosphate-coating, and painting line, with many advanced features. Components such as circuit-breaker panels and cover plates are first loaded by hand, from skids or boxes, on to specially-designed hangers, as seen in Fig. 5, in such a manner as to permit maximum drain off of paint and other fluids that are applied during processing. The hangers are spaced 18 in. apart on the overhead conveyor.

From the loading station, the conveyor enters a 5-stage spray-cleaning and coating installation supplied by the Detrex Corporation, Detroit 32, U.S.A. The parts are first pressure sprayed with a 2 per cent solution of Oakite No. 96 (Oakite Products Co., Inc., New York, 6) at a temperature of 160 deg. F. for precleaning, and this treatment is followed by hot water rinsing. At the third stage, a solution of Oakite CrysCoat No. 89 (iron-phosphate coating material) is sprayed on to the parts, which then enter a cold water rinse. Finally, the work is rinsed in a solution of Oakite No. 31, maintained at a temperature of 160 deg. F., for the purpose of improving the corrosion resistance of the phosphate coating, and providing for better paint adhesion.

On leaving the last stage of the Detrex unit, the conveyor carries the parts through a drying oven maintained at 375 deg. F., where all moisture is removed before the paint is applied. In Fig. 6, the upper portion of the conveyor is carrying parts to the Detrex unit for cleaning and phosphating, while parts on the lower conveyor are emerging from the drying oven.

For painting, the conveyor immerses the parts in a 1,500 gal. tank of paint, from which samples are taken hourly to check the viscosity and colour. The latter is corrected by additives whenever necessary, since a constant colour is important to ensure

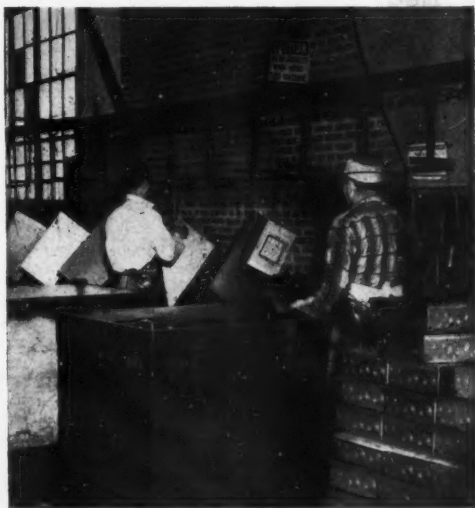


Fig. 5. Loading circuit-breaker panels and cover plates on to the paint line conveyor. Specially-designed hangers are provided, which permit the paint and other applied liquids to drain off

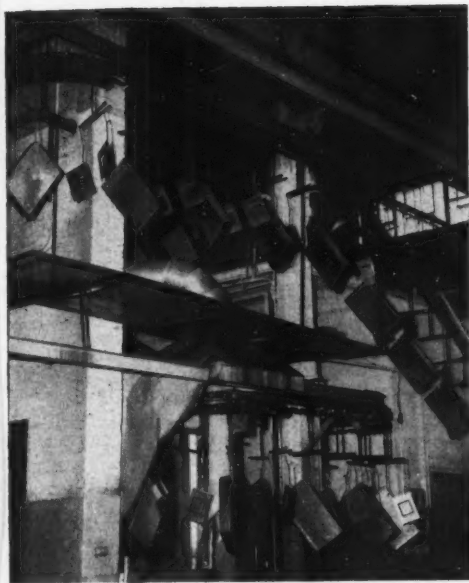


Fig. 6. In this view, panels on the top section of the conveyor are moving to the spray-cleaning installation, on the lower section, phosphate-coated parts are emerging from the drying oven on the way to the dip-painting tank

matching when parts which may have been painted at widely-spaced time intervals are assembled together, or are placed adjacent to each other.

The paint is maintained at a constant temperature, which is a contributory factor in ensuring correct matching of colour on all parts regardless of when they are painted. Baking is the last operation before unloading, and is carried out in an oven at a temperature of 340 deg. F., through which the parts are conveyed in about 9 min. The overall length of the conveyor system is approximately 1,000 ft., and the work travels from the loading to the unloading station in about one hour.

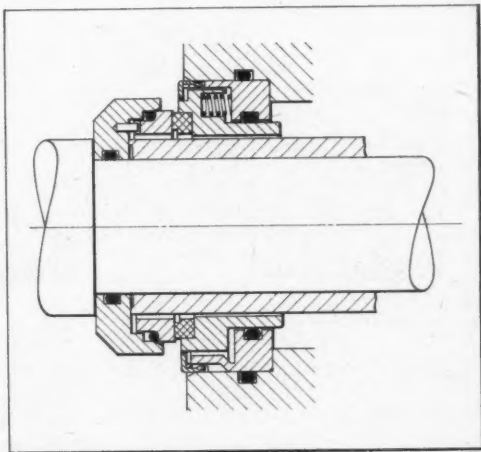
All operations performed on the line are regulated automatically from a central control console. In case of fire, it is only necessary to press an emergency control button to disconnect the electrical power. At the same time, a valve is automatically opened to empty the contents of the paint tank into a special outdoor storage tank. A carbon-dioxide foam blanket is applied automatically to the entire area when the temperature rises above a certain figure.

Flexibox Type DD High-speed Mechanical Shaft Seal

The type DD mechanical shaft seal, which has been introduced by Flexibox, Ltd., Nash Road, Trafford Park, Manchester, 17, will withstand pressures and temperatures up to 1,000 lb. per sq. in. and 500 deg. F., and is primarily intended for use where the space available in the axial direction is restricted and high peripheral speeds—up to 15,000 ft. per min.—are involved. Various standard sizes can be supplied, to suit shafts from $\frac{1}{4}$ to 8 in. diameter, and larger units can be made, if required.

Arranged for press fitting in a recess in the casing through which the shaft projects, the unit is designed for inclusion in a balanced system, and incorporates a sleeve, which is resiliently mounted in a housing by means of packing and does not rotate. The sealing ring is carried at the flanged left-hand end of this sleeve, and is shown cross-hatched in the accompanying sectional view. Compression springs, housed in pockets spaced around the rear face of the flange, engage an annular face on the housing and serve to urge the sleeve to the left, to maintain the sealing ring in contact with the opposing rotary seat. With this arrangement, it is claimed, uniform pressure between the ring and the seat is ensured.

Units of three types can be supplied, namely reverse balanced, and with O-rings or chevron packings for the sleeves, and there is a choice of two axial tolerance ranges, and three face loadings.



Sectional view showing an application of a Flexibox type DD high-speed mechanical shaft seal

Westool-Sonac Sensing and Switching System

A new sensing and switching system, known as the Westool-Sonac, with which an ultrasonic sound beam is employed, is now available from Westool, Ltd., St. Helen's, Auckland, Co. Durham. This system was developed by the Delavan Mfg. Co., West Des Moines, Iowa, U.S.A., and it is expected that it will find wide application in industry for automatic counting at rates up to 1,000 counts per min., package routing, level control, positioning, sorting, and many other control operations.

There are three major parts, namely a control unit which contains a transistorized amplifier, a plug-in output relay and a power supply; and two hermetically-sealed, acoustic sensors, as seen in Fig. 1. The two matched sensors convert electrical energy to ultrasonic energy and vice versa, one sensor acting as a transmitter and the other as a receiver to provide circulation around a closed loop.

It is stated that the system will detect solids or liquids, opaque or transparent objects, and ferrous or non-ferrous metals. Objects may be fast or slow moving, and at a wide range of distances. Moreover the beam can be made several feet wide or directed through holes down to about 0.030 in. diameter. A beam will follow almost any path as long as there is not direct obstruction. The units can therefore be remotely located, and the ultrasonic beam can be transmitted to the work area

through flexible tubing, and, if necessary, caused to pass round corners.

With the Sonac system, one sensor is connected to the amplifier and operates essentially as a loudspeaker. This transmitting sensor produces ultrasonic waves of the quantity and frequency delivered to it by the amplifier. The other—receiving—sensor, is connected to the amplifier as a microphone and will deliver to it, as electrical energy, any ultrasonic vibrations that reach the diaphragm. The amplifier is capable of amplifying the weak vibrations fed to the receiving sensor more than 1,000,000 times.

The Sonac sensors are by design definitely directional in their response to ultrasonic waves. If the transmitting and receiving sensors are positioned facing each other, and the path between them is unobstructed, and the electrical gain in the amplifier is sufficient to overcome the losses in ultrasonic energy across the path, "acoustic feedback" will occur. If the gain control of the amplifier is set just sufficiently high to overcome the path loss between the sensors, and some object capable of absorbing or reflecting some of the ultrasonic energy is placed in the path, the electrical gain becomes insufficient to maintain the "acoustic feedback" on account of the larger loss in the path. This change in condition causes the control relay of

the amplifier to operate, and some external device may thus be energized to initiate a secondary operation. The direct path method can also be employed for sensing the removal of an object from the beam. With the object obstructing the beam, the output relay is de-energized. When the object is removed, the acoustic path is completed, and the relay is energized.

When the acoustic characteristics of the air path are changed by variations in temperature, relative humidity or standing wave conditions, the Sonac system adjusts itself to some new frequency which is optimum for the path conditions then prevailing.

To avoid interference by sounds or vibrations from other sources, the sensors are designed to operate only over a narrow spread of frequencies in the 38,000 cycles per sec. range. Each pair of sensors supplied with



Fig. 1. The transistorised amplifier and relay unit, and two hermetically-sealed acoustic sensors for the Westool-Sonac sensing system

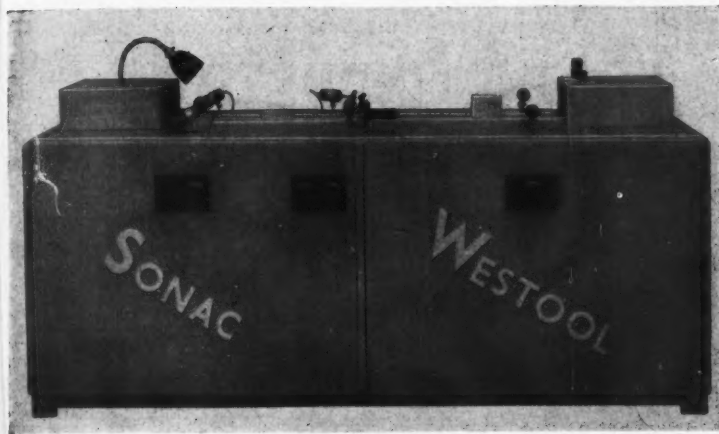


Fig. 2. Demonstration unit which shows the operation of the Sonac sensing and switching system now available from Westool, Ltd.

Sonac equipment is matched within ± 20 cycles and they must be used as a pair. To permit operation of several Sonac devices in close proximity, matched sensor pairs are supplied which have different frequency characteristics so as to avoid interference between the systems. The sensors, which are all metal, and hermetically sealed, measure 1½ in. diameter by 2¼ in. long, and can be used at temperatures from +220 to -350 deg. F.

Two modified sensors, known as the coupler, and the focalizer, are available for specialized applications. The coupler sensor reduces the ultrasonic waves down to a small area for transmission through flexible rubber hose or metallic pipe, to reach locations too confined for the application of general-purpose sensor installations. The focalizer sensors incorporate parabolic reflectors to provide beams of narrower angle than those transmitted by general purpose units. They are intended for applications that require beam paths of more than 20 ft., or narrow concentration of the beam in paths of less than 20 ft.

In addition to direct-path, the sensors can be arranged for operation with a reflected path. With this method, the ultrasonic waves emitted from one sensor are reflected from an object to the second sensor, to provide the acoustic path. When the object is removed from the path, the relay is de-energized. Conversely, the relay is energized when an object establishes the path. The reflection method, it is stated, is particularly suitable for counting or sensing small objects.

A specially-built demonstration unit, which illustrates the operation of the system, is seen in Fig. 2.

Three pairs of sensors are fitted along a continuous belt conveyor. The pair on the right is arranged for counting boxes in very dusty and dirty conditions provided by a dust sprayer fitted beside the belt. At the centre, there is a pair arranged to sense for height. When a box passes which is higher than the remainder on the belt the beam is broken and a solenoid is operated. The third pair, on the left, operates in conjunction with a flashing light.

Among the main other applications of the system may be men-

tioned the guarding of presses and other machinery, level control in bins and hoppers, and detection of web breakage.

The Attitude of Small and Medium-sized Firms to Export Trade

(Continued from page 347)

is involved or how to set about it." The point which it is essential to grasp, the authors continue, "is that in practically no case have we found any evidence that a firm which really wanted to export would find any serious difficulty in doing so."

Enquiries also revealed that there were striking differences of opinion on certain matters between managing directors of exporting and non-exporting companies. Those who exported had found that they could easily get export information, that the Board of Trade was helpful, and that ignorance of foreign languages was no barrier to trade. On the other hand, many non-exporters gave these as their principal reasons for not entering markets abroad.

In the circumstances, it is not difficult to understand why those responsible for the survey suggest that it may "possibly be more immediately effective to concentrate on encouraging those firms which already export to export more." At the same time it appears that the non-exporters could collectively contribute very substantially, if they wished, to the rapid expansion of export trade, and there is plenty of evidence that "the self-interest of the individual manufacturer and the long-term interests of the national economy can both be served by greater attention to the possibilities of export."

NEWS OF THE INDUSTRY

Keighley

HEWITT & TOPHAM, LTD., Foster Road, Ingrow, who are specialists in gear production, report an exceptionally heavy demand from an increasing number of customers in a wide variety of industries. The company supplies worm gears up to 12-in. centres, spur gears up to 48 in. diameter and bevel gears up to 25 in. diameter.

There is an exceptional strong request at present for various bevel driving units and worm reduc-

tion units, the latter covering a ratio range from 10:1 up to 60:1.

WARD, HAGGAS & SMITH, LTD., Parsons Street, report a steady demand for their range of machine tools. It was noted that a substantial volume of orders and enquiries is at present being received from the Admiralty, that a repeat order is in hand for a large planing machine for export to Pakistan, and that other machines on order for export include a number for delivery to Singapore.

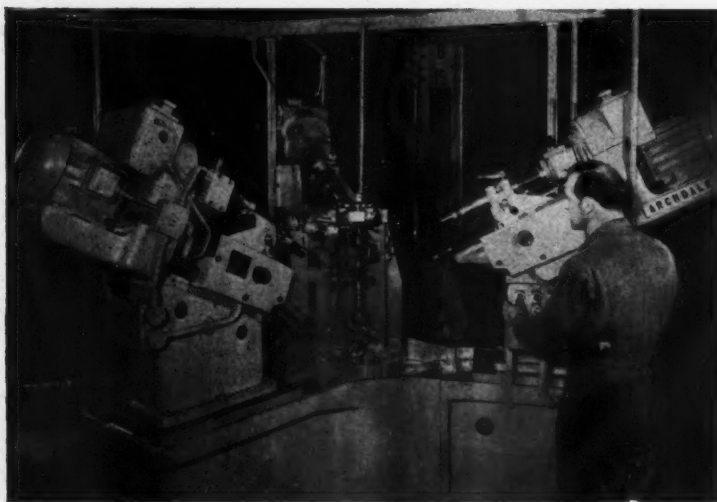
DEAN, SMITH & GRACE, LTD., inform us that the call for their range of machine tools, which includes centre lathes from 13- to 32-in. swing, surfacing and boring lathes from 16- to 24-in. swing, and a 17-swing capacity toolroom lathe, is being well maintained. Special mention is made of the increasing number of orders for lathes having built-in copying units. Comprehensive catalogues of copying lathes and equipment have been produced, and copies are available from the above address. New plant recently installed in the works includes an Alfred Herbert type F hexagon turret drilling machine; two B.S.A. No. 5.M. single-spindle automatics; a Keighley internal grinder with a capacity of 16 in. diameter by 4 ft. long; and a Cincinnati duplex Hypowermatic milling machine.

A. FIELDING & Co. (KEIGHLEY), LTD., Aire-dale Works, Bradford Road, are busy with the production of their 16- and 18-in. swing centre lathes. We are informed that a good volume of orders is in hand at present, and that approximately 50 per cent of the output is being regularly exported, India and Nigeria being mentioned as two of the main export customers.

Work now in progress includes two special-pur-

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This Archdale special purpose deep hole drilling machine is installed in the line for 3-cylinder crankshafts at the works of F. Perkins, Ltd., Eastfield, Peterborough. It is one of two employed for drilling the oil holes connecting the main bearing journals with the crankpins. Loaded with the flywheel flange at the top, the crankshaft is secured by three clamps, two of which also provide for location. The drill heads withdraw automatically after each $\frac{1}{8}$ -in. of feed, for swarf clearance, and a thrust and torque overload device is incorporated which ensures withdrawal of the drills if they should stick or encounter any obstruction. Drilling is completed in a cycle time of 6 min.



pose lathes equipped with rear tool-posts, and it was noted that this company also undertakes the construction of special-purpose machine tools and equipment, on a contract basis, to the individual requirements of customers.

CHARLES DALE & CO., LTD., East Parade, makers of special machine tools and equipment to customers' specifications, report that all departments of their works are extremely busy. This company also undertakes the contract machining of a wide variety of components for various branches of industry, including machine tool, mechanical handling equipment, and foundry equipment manufacturers, and the motor car trade. We are informed that delivery of a Scharmann, 3½-in. diameter spindle, horizontal boring and milling machine is expected shortly.

N. HARGREAVES & Co., Luton Street, Keighley, are busy with the production of machine tools on a contract basis. Other activities of this company include reconditioning and general maintenance, for the local engineering industry, of all types of machine tools and equipment. This company has lately installed a number of machine tools, and the more recent additions to the plant have included Kitchen & Wade E. 25. 3-ft. and T.7. 32-in. radial drilling machines; Victoria U.2. and U.O. milling machines; and a Zimmermann horizontal borer.

R. SUTCLIFFE.

Leicester

ELLICOCK & HEALY, LTD., Dorothy Road, have made arrangements for increasing the output of precision parts, jigs, fixtures, and gauges from their works, by providing additional floor space and installing new machine tools, including two Willson 8½-in. centre lathes, a Kitchen & Wade radial drilling machine, and a Ward No. 2A capstan lathe. Work in progress, to which our attention was drawn, includes gauges and fixtures for gas turbine parts, and components for nuclear energy equipment. This company, which is A.I.D. and A.R.B. approved, has also specialized for a number of years in the building of sanding, polishing and disc-grinding machines, arranged for bench or floor mounting. Both types are provided with 16-in. diameter abrasive discs, and can also be employed for fine or coarse sanding operations. Grinding discs of honeycomb face pattern may be employed to obtain increased rates of stock removal. If required, these

machines can be provided with self-contained dust collecting equipment. They are widely employed for operations on metals, plastics, rubber, stone, and wood.

MARWIN (ANSTEY), LTD., Anstey, who make an extensive range of tungsten-carbide tipped tools, are still well placed for orders for most of their standard products, including a wide variety of tools for turning, boring, shaping, and planing operations; die sinking cutters; end mills; shell face milling cutters; inserted blade face mills up to 16 in. diameter; reamers with replaceable cutting ends; Chuckmill face mills, which are designed for fitting to existing types of end-mill chucks with the aid of a patented adapter; and side-and-face milling cutters. The company also builds double-ended dual-speed grinding and lapping machines, for bench or pedestal mounting, which may be fitted with silicon carbide wheels, Carbolap wheels, or diamond wheels, as required.

A 9,000-sq. ft. extension to the works, which is expected to be ready for occupation after the

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Birmingham Sound Reproducers, Ltd., have installed some 30 dynamic balancing machines in their factories at Old Hill, Staffs., and London-derry. These machines, which were supplied by E.M.I. Electronics, Ltd., Hayes, Middlesex, are employed for balancing the rotors for driving motors for record changers and tape decks. The motors run at 3,000 r.p.m. and accurate balance is important, to reduce "rumble" and "flutter" as much as possible. On the E.M.I. machines balancing is carried out to an accuracy of 10 mg.-cm. by semi-skilled girls, after suitable training



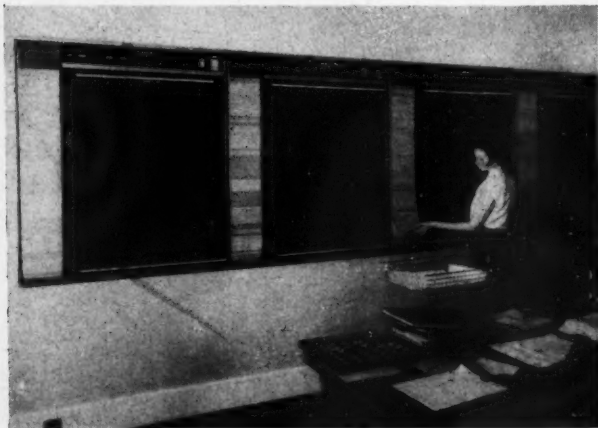
holiday period, will enable the output of Marwin cutting tools for delivery to the home market and to a growing number of overseas customers to be substantially increased. Two form-grinding machines and a new induction heating plant have recently been installed.

TAYLOR, TAYLOR & HOBSON (a division of Rank Precision Industries, Ltd.) are experiencing a brisk demand for their various products, including Tallysurf surface roughness measuring and Talyrond roundness measuring equipment. The Model 2 version of the latter will accept work up to 50 in. long by 10 in. diameter and is employed in the motor vehicle industry abroad for checking crankshafts, camshafts, and half-shafts. Developments are in progress to increase the length of stylus arm from 10 in. to 15 in. without adversely affecting the existing radial magnification. The type 105 Tallysurf portable surface measuring instrument is suitable for measuring bores down to $\frac{1}{8}$ in. diameter and 11 in. long.

Varotal type 3 dual-range television camera "zoom" lenses are now in production, for supply to broadcasting organizations at home and overseas. The lens design department is deriving considerable assistance from the Elliott 402 electronic computer

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The illustration shows a wall chart installation which was supplied by Adapta-Charts, Ltd., 129 Hammersmith Road, London, W.14, to Walter Somers, Ltd., Halesowen, Worcs. With the aid of the four charts, some 300 orders for crankshafts and large forgings can be progressed through six main stages and ten subsidiary stages. Among the advantages claimed for the system is the fact that overdue items are immediately visible. Moreover, the load on any particular department can be easily ascertained



which was installed in order to facilitate calculations associated with optical equipment. It is claimed that the speed and accuracy of this computer is such as to enable routine ray tracing calculations, for example, to be completed in 1/200th of the time required previously, when traditional methods were employed. Machine tools recently installed in the shops have included a Ward No. 2 DS capstan lathe, a Tarex 90/90 automatic, a B.S.A. 168 L automatic with a thread chasing attachment, and a Upam bandsawing machine with automatic stock feeding equipment.

A. A. JONES & SHIPMAN, LTD., Narborough Road South, are as busy as ever in meeting the demand from home and export markets for a wide range of grinding machines, mainly of production types. Orders for Micromatic honing machines are stated to be satisfactory, and there is sustained activity in the machine tool agency department, machines recently ordered having included a slideway grinder built by Familleureux-Giddings & Lewis. Business is also well maintained in the small tools section. A works extension of 25,000 sq. ft. area is to be built and it is expected that it will be occupied early next year. A number of Ward capstan lathes and Edgwick centre lathes have been installed during recent months. Other machine tools are on order, including a slideway grinder and a planing machine. The company has a number of apprentices undergoing training, and other employees are receiving limited instruction to fit them for specific tasks.

F. W. HERRIDGE.

Rochdale

BUTTERWORTH BRITISH AUTOMATIC MACHINE TOOL CO., LTD., Lincoln Street, are busy with the production of their range of automatic machine tools, and it may be noted that a considerable volume of special tooling is regularly being designed and made to suit customers' requirements.

We are informed that a steady export trade in machines and equipment is being maintained, and that Australia is one of the principal customers at present.

DAVID BRIDGE & CO., LTD., Queensway, Castleton, report that they are working to full capacity, their exclusive range of machinery for the plastics, rubber, and associated industries being in keen demand. The company is now exporting to many overseas markets, including the

U.S.S.R., and work has recently begun on a large contract for Rumania.

To enable output to be increased a works re-organization scheme is in progress which includes the erection of a new assembly bay. This extension, which is now nearing completion, covers an area of some 21,000 sq. ft., and is of sufficient height to provide 30 ft. of headroom beneath the cranes.

L. E. WILSON (DIE CASTING), LTD., Trows Works, Trows Lane, Castleton, inform us that they are extremely busy with the production of a wide variety of gravity die castings in both aluminium and aluminium-bronze. It may be noted that there has been a large increase in recent months in the volume of new work handled, mainly for the electrical equipment and food processing machinery industries. Capacity has been increased by the installation of two small pressure die casting machines for zinc-base alloys. The tool-room, in addition to producing dies for use in the foundry, undertakes die-making on a contract basis for other companies.

TAYLOR INDUSTRIAL CLUTCHES, LTD., Upper Trows Works, Castleton, are experiencing an increasing demand for their range of wet and dry multi-plate clutches and brakes. In addition, many orders are being received for pneumatically- and hydraulically-operated clutches and brakes for use on presses. The standard range covers capacities from 50 to 500 tons, and special types can be supplied for presses with ratings up to 2,000 tons.

There has been a steady increase in the volume of direct export orders received in recent months, and in particular, many mechanical clutches are being supplied to India for use on machine tools.

TWEEDALES & SMALLEY, LTD., Castleton, makers of machines and equipment for the textile industry, report a sustained call for their products from both the home and export markets. The foundry, which has been partly mechanized, is maintaining an output of approximately 90 tons of ferrous and non-ferrous castings per week.

Industrial air-conditioning and refrigeration plant, and passenger and freight lifts, are now in regular production in the new works extension.

FROST (ROCHDALE), LTD., Crawford Street, Rochdale, inform us there is a steady demand from customers at home and overseas for their range of

machines and equipment. Work in progress at the time of our visit included adjustable circular shearing machines, folding machines, and plate bending rolls, also treadle and overcrank guillotine shears of various sizes.

TURNER BROTHERS ASBESTOS CO., LTD., Spotland, are experiencing a heavy demand for all their products, including asbestos textiles of various types, conveyor belting, and transmission belting of both flat and vee forms. Particular interest is being shown in the recently-introduced Poly-Vee drive units.

JOHN HOLROYD & CO., LTD., Milnrow, inform us that their ranges of single- and double-reduction units are in keen request at the present time, and that a steady volume of orders is being received by the contract gear cutting department. The demand for milling machines, and especially for the rotor milling type, is being well maintained both at home and abroad. An increasing call is also reported on the company's services as rotor milling specialists, by customers in many parts of the world.

R. SUTCLIFFE.

Mapperley Engineers, Ltd.

The first stages of an expansion programme have recently been completed by Mapperley Engineers, Ltd., Haywood Road, Mapperley, Nottingham, with the transfer of plant to a new machine shop, as shown in the accompanying illustration.



A view in the new machine shop which has recently been occupied by Mapperley Engineers, Ltd.

This company took over a small precision and repetition engineering business in 1951 for the purpose of producing components under sub-contract. About two years ago it was decided to purchase additional plant and to plan for production on a larger scale, and it is reported that output has been increased by 100 per cent since the beginning of 1960. With the new shop and plant in operation, it is hoped to expand production by a further 50 per cent during the next 12 months. Hitherto the capacity of the works has been heavily taxed, but with the improved facilities now available, more repetition work can be accepted.

At present, components of wide variety are being produced, for example, for motor vehicles, agricultural and hosiery machines, and domestic electrical appliances.

Demonstrations to be given in Brussels

A Tracemaster type TM43A 3-dimensional copy milling machine built by Hayes Engineers (Leeds), Ltd., and 18- and 26-in. stroke Super shapers from the range made by the Butler Machine Tool Co., Ltd., Halifax, member companies of Associated British Machine Tool Makers, Ltd., 17 Grosvenor Gardens, London, S.W.1, will be demonstrated throughout the period of the 7th European Machine Tool Exhibition, to be held in Brussels from September 3 to 12, at the showrooms of Société d'Importation de Machines-Outils S.A., 90 Avenue Clémenceau, Brussels-Midi. The latter company is the agent in Brussels for A.B.M.T.M.

Industrial Notes

AN AUCTION SALE OF VEHICLES, MACHINE TOOLS and miscellaneous stores will be held at the W.D. Storage Depot, Bow House, Hurlford, near Kilmarnock, Ayrshire, on August 24. The auctioneers will be Dixon & Wallace, Ltd. (Dept. L), Bank Buildings, Graham Square, Glasgow, E.1.

ACCIDENTS—HOW THEY HAPPEN.—The latest issue of this H.M. Factory Inspectorate Publication (H.M. Stationery Office. Price 1s. 3d. net) describes typical accidents under the headings handling, transport, process machinery, and electricity, and suggests how they might have been avoided.

THOR TOOLS, LTD., Special Products Department, Tynemouth, Northumberland, have introduced a service which provides for the design and construction of special multi-spindle attachments for application to obsolete drilling, nut-running, tapping, and stud-setting machines, to enable them to be employed efficiently. It is stated that estimates are supplied without obligation.

THE INSTITUTE OF SERVICE MANAGEMENT, 68 Church Avenue, Pinner, Middlesex, announce that S. N. Bridges & Co., Ltd., have become the first "patron company" of this newly-formed organization. It is stated that the

membership, as a result of the most recent applications, has now increased to 50, and includes manufacturers of canteen equipment, domestic appliances, power tools, and electronic and radio equipment.

SAFETY IN THE USE OF IONISING RADIATIONS, a safety code for workers exposed to ionising radiations in industry is laid down in the Ionising Radiations (Sealed Sources) Regulations, 1961 (S.I. No. 1470, H.M. Stationery Office. Price 9d. net), made by the Minister of Labour, Mr. John Hare, and presented to Parliament on August 3. Most of the requirements will come into operation in six months' time, but those requiring the notification of the use and disuse of ionising radiations in factories are now effective.

DEPARTMENT OF SCIENTIFIC AND INDUSTRIAL RESEARCH, Charles House, 5-11 Regent Street, London, S.W.1, have issued a 12-page booklet entitled "Instruments in the Factory," by J. Thomson, in which attention is drawn to the advantages to be gained from the use of suitable instruments for the control of various industrial processes. There are sections entitled: simple instruments save money, how it is done, factory instrumentation, from "watch-keeping" to automatic control, improvements in your product, and cutting the cost.

F. J. STOKES, LTD., Mercury House, Hanger Green, Ealing, London, W.5, announce that they are now able to supply the new type 725, air-operated, automatic transfer moulding press, of 25 tons capacity, which has been introduced by the Plastics Moulding Division of the parent company, F. J. Stokes Corporation, Philadelphia, U.S.A. These presses, which will be built for the company by Thomas White & Sons, Ltd., Paisley, are of simple design and are intended to enable fully automatic moulding to be economically employed for short production runs with inexpensive moulds.

BRITISH IRON AND STEEL FEDERATION, Steel House, Tothill Street, London, S.W.1, have issued a publication entitled: "Steel in the 1960's—Developments by the Companies." Including some excellent illustrations in full colour, this publication is in two parts, the first being concerned with major developments by leading steel producing companies, and the second with the implications of the programme. In the latter part, separate sections are devoted to mill developments and products, "the revolution in steelmaking," and ironmaking and raw materials.

GIDDINGS & LEWIS MACHINE TOOL CO., Fond du Lac, Wisconsin, U.S.A., recently reported that new orders booked during the six months ended July 31 were at an annual rate which was one-third higher than the rate for 1960 and that "present sales activity was most encouraging." In a statement to shareholders, the president and general manager, Mr. Ralph J. Kraut, remarked that whereas shipments for the second half of the year were expected to show a substantial increase over those for the first half, more than 50 per cent of all shipments this year would be accounted for by completely new and numerically controlled machines—with costs highly unpredictable and variable. He also indicated that it was intended to continue and accelerate the research and development programme in which the company has been engaged for some time.

Books Received

BRITISH NUCLEAR POWER STATIONS. By Rolt Hammond, A.M.I.C.E. Macdonald & Co. (Publishers), Ltd., 16 Maddox Street, London, W.1. 182 pp. [Price 25s. net.]

In this non-scientific survey of the present position as regards the development of atomic power in this country, attention is drawn to the economic implications of its introduction, and an attempt has been made to forecast future extensions. Chapters are devoted to the Calder Hall, Hinkley Point, Berkeley, and Hunterston projects, and others are concerned with the design of nuclear stations, research, the Dounreay sphere, and thermo-nuclear power.

HEAT TREATMENT AND PROPERTIES OF IRON AND STEEL. By Thomas G. Digges and Samuel J. Rosenberg. U.S. Department of Commerce, National Bureau of Standards, Washington 25, D.C., U.S.A. [Price 45 cents.]

This monograph (No. 18) of 40 pages covers, in simplified form, the basic theoretical and practical principles involved in the heat treatment of iron and steel. The effects of the various treatments on the structures and mechanical properties are described, but some theoretical aspects and technical details are discussed only briefly, or omitted entirely, to enable a better understanding of the subject as a whole to be obtained. A list of all structural, tool and stainless steels in use in the U.S.A. is included, together with recommendations for heat treatments.

DIRECT CURRENT MACHINES. By H. B. Ranson, B.Sc., A.M.I.E.E., A.M.Brit.R.E., and E. T. A. Webb, A.M.I.E.E. Cleaver-Hume Press, Ltd., 31 Wright's Lane, London, W.8. 320 pp. [Price 21s. net.]

Although alternating current has many practical advantages, notably as regards transmission and transformation, there are many applications of electric power for which only direct current is satisfactory. The authors emphasize this fact and have covered, in a relatively small space, all the most important aspects of direct-current machines, including design, construction, performance characteristics, and control. Treatment is largely non-mathematical, although certain fundamental formulae are used in the accompanying arithmetical examples. The book is to be recommended as an excellent introduction to the subject, and for purposes of practical reference.

CHIPLESS MACHINING. By Charles H. Wick. The Industrial Press, New York. The Machinery Publishing Co., Ltd., National House, West Street, Brighton, 1. 502 pp. [Price 90s. net.]

Methods of forming metal to the required finished shapes without the production of chips are receiving increasing attention and are being more widely adopted by the metal-working industries on account of the savings in cost that can thus be obtained. The author of this book has brought together the relevant data already available, to provide a useful practical guide. Processes covered include cold heading; the rolling of threads, serrations, splines, and gears; power spinning; rotary swaging; cold forming; and cold extrusion; also explosive and other high-energy-rate forming methods. Much space has been devoted to the cold extrusion process, and matters discussed include the selection of material, design of parts, phosphate coating and lubrication, die design, and choice of press.

MACHINERY'S ENQUIRY BUREAU

For many years MACHINERY has provided an enquiry service not only for subscribers and advertisers but for all engineers in need of such information as the names of makers—or their agents—of machines or equipment for performing particular operations, suppliers of various classes of material, firms with facilities for undertaking certain types of work, owners of trade names, and agents for foreign machine builders. If you have such a problem write (MACHINERY, Enquiry Bureau, Clifton House, 83-117 Euston Road, London, N.W.1) or telephone (Euston 8441, 2 lines). This service is, of course, entirely free.

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Personal

MR. A. H. (JACK) DANIEL has recently retired from George Kingsbury & Co. (Machine Tools), Ltd., 54 Victoria Street, London, S.W.1. Mr. Daniel has been associated with the British agents for Index automatics for more than 35 years.

The following new appointments have been announced:—

MR. R. C. THOMPSON, C.B.E., M.A., and MR. J. F. BUTLER, M.A., A.M.I.Mech.E., as directors of William Duxford & Sons (Engineers), Ltd., Pallion, Sunderland.

MR. G. F. LAURENCE, director of technical services for Metalastik, Ltd., Evington Valley Road, Leicester, as a deputy managing director of the company.

MR. N. D. MACDONALD, general works manager of the Workington Iron & Steel Co. branch of The United Steel Companies, Ltd., The Mount, Broomhill, Sheffield, 10, as a director of the branch.

MR. H. F. SHERBORNE, M.C., managing director of Yorkshire Imperial Metals, Ltd., P.O. Box No. 166, Leeds, as president of the British Non-Ferrous Metals Federation, in succession to Mr. W. W. Dolton, managing director of the Delta Group of companies. Mr. Sherborne represents the Federation on the Council of the British Non-Ferrous Metals Research Association.

Trade Publications

ALLEN WEST & Co., LTD., Lewes Road, Brighton 7. Illustrated leaflet describing the new Type UAC range of unit contactors which are available in ratings of 15, 25, and 50 amp.

TELEPHONE RENTALS, LTD., 197 Knightsbridge, London, S.W.7. Leaflet drawing attention to the TR internal telephone, internal broadcasting, time control, machine performance recording, fire alarm, and fire detection systems.

MORGANITE CARBON, LTD., Battersea Church Road, London, S.W.11. Issue No. 2 of the technical Bulletin "Carbon and its Uses" includes a detailed article on a new approach to brush pressure measurement, and another on the advantages, design, and applications of carbon seals. Carbon electrical contacts are also discussed, and attention is drawn to some interesting new applications of carbon.

CRODA, LTD., Cowick Hall, Snaith, Goole, Yorkshire. Revised technical data sheet covering anti-corrosive and other protective materials manufactured by the company to Government and other official specifications. Another data sheet is concerned with Prevok general purpose rust preventive which provides a solvent deposited film of protective material. This film, it is stated, is soft but tenacious.

TRUMETER CO., LTD., Milltown Street, Radcliffe, Manchester. Fully illustrated catalogue describing the Trumeter range of revolution counters, stroke counters, and yardage counters. Printing counters are also listed,

together with electro-magnetic counters and various types for special applications. In all, reference is made to more than 40 different forms of counting instruments in the 14 sections of the catalogue.

C. E. JOHANSSON, LTD., Southfields Road, Dunstable, Beds.—Second edition of the company's pocket-size booklet, entitled "CEJ Screwing Taps and their Use." In general only minor changes have been made, but attention may be drawn to the inclusion of the ISO-Metric and Unified thread recommendations. A great deal of useful information is conveniently presented and there is a list of contents to facilitate reference. Apart from notes on such subjects as through holes, cutting rakes, re-grinding, lubricants, tap zones, tap nomenclature and thread designations, sections are devoted, for example, to diameters and pitches, thread depths, tapping drills, and basic forms and tap tolerances for the principal types of threads.

Scrap Metals

↑LONDON.—↑Prices per ton for non-ferrous scrap metals free from iron are as follows:—Clean copper wire, untinned and free from lead and solder, £200; clean heavy copper, untinned and free from lead and solder, £194; copper wire No. 2, £190; clean light copper, £186; braziers copper, £163; gunmetal, £174; brass, mixed, £126; lead, net, £51; zinc, £40; cast aluminium, £93; old rolled aluminium, £96; battery lead, £28; unsweated brass radiators, £102; hollow pewter, £565; black pewter, £445.

MIDLANDS.—Trade is quiet generally, since many works are closed for annual holidays. In connection with coppers uncertainty has persisted, and when normal trading is resumed this metal is still likely to be viewed with a certain amount of caution, unless any interruption in production causes concern and a resultant increase in price.

Tin is still in strong demand and some doubt regarding supplies has resulted in a rise in market value of about £10 per ton. The price of tin has of course been reflected in a better demand and price for white-metal scrap.

The position as regards various metals and alloys is as follows:—

Copper. Prices for most grades show little change.

Brass. Consumer demand is primarily for mixed heavy material, but all grades find ready outlets.

Gunmetal. Prices are firm with little change. Demand is good and this applies particularly to the high quality bronzes.

Lead. There has been a small easing in price on a slow market, which appears to be affected only by demand, production being ample to meet all requirements.

Aluminium. No marked changes in values has occurred. Buyers are very selective and obviously carry sufficient stocks to meet present requirements. A better price tone cannot be foreseen in the near future, with the motor car trade entering a period when production is usually at the lowest level.

Zinc. Demand is fairly steady, but prices have fallen by about £1 to £2 per ton.

↑ George Cohen, Sons & Co., Ltd., 606 Wood Lane, London, W.12
‡ Subject to market fluctuations.

Machine Tool Share Market

Stock markets were fairly active during the period under review, but after being mainly steady to firm, they became irregular, and most sections finished on a subdued note.

The gilt-edged sections suffered some sharp setbacks at the outset, but gradually rallied to end with some striking improvements among British Government stocks and kindred issues.

Commercial and industrial share markets displayed an upward trend for the most part under the influence of the Trustee Investments Bill which permits trustees to invest up to half their funds in equities.

Towards the close, however, an easier tendency developed owing to a falling off of the investment demand, and final prices were below the best.

Among machine tool issues, Arnott & Harrison advanced 3d. to 9s.; Birmingham Small Arms, 2s. to 23s. 6d.; Broom & Wade, 2s. 3d. to 24s. 9d.; Chas. Churchill, 3d. to 9s. 3d.; Clarkson Engineers, 1s. 6d. to 7s. 6d.; Coventry Gauge & Tool, 3s. 3d. to 29s. 4½d.; Craven Bros. (Manchester), 10½d. to 9s. 1½d.; Alfred Herbert, 3s. to 66s. 6d.; A. A. Jones & Shipman, 3s. 9d. to 27s. 6d.; Samuel Osborn, 2s. 3d. to 49s. 6d.; Ambrose Shardlow, 2s. to 60s.; John Shaw & Sons (Wolverhampton), 7½d. to 15s. 7½d.; and

Thos. W. Ward, 6s. 3d. to 73s. 9d. On the other hand, British Oxygen lost 6d. at 20s.; Butler Machine Tool, 1s. 3d. at 15s.; John Harper, 7½d. at 7s.; B. & S. Massey, 1s. at 10s.; F. Pratt, 6d. at 17s. 9d.; and Sanderson Kayser, 3s. 1½d. at 29s. 4½d.

New Companies Registered*

LAKE & ELLIOT FOUNDERS & ENGINEERS, LTD., and LAKE & ELLIOT JACKS & EQUIPMENT, LTD. Albion Works, Braintree, Essex. Registered July 20, 1961. To acquire the whole or any part of the undertaking and assets of Lake & Elliot, Ltd., and to carry on business of iron and steel foundries, mechanical engineers, etc. Nom. cap.: £100 in £1 shares. Directors not named.

BRIDGWATER MACHINE CO., LTD. Registered July 21, 1961. To carry on the business of founders, converters, fabricators, extruders, forgers and manufacturers of iron, steel, aluminium and other metals, manufacturers of and dealers in machinery, equipment, tools, etc. Nom. cap.: £200,000. Directors not named. Subscribers: R. P. Broadley and D. M. Renshaw, 9/12 Cheapside, London, E.C.2.

* From the lists compiled by Jordan & Sons, Ltd., Company Registration Agents, 116-118 Chancery Lane, London, W.C.2.

COMPANY		Denom.	Middle Price	COMPANY		Denom.	Middle Price
Abwood Machine Tools, Ltd.....	Ord.	1/-	1/9	Herbert (Alfred), Ltd.....	Ord.	£1	66/6xd
Allen (Edgar) & Co., Ltd.....	Ord.	£1	37/-	Holroyd (John) & Co., Ltd.....	"A" Ord.	5/-	20/-
	5% Prf.	£1	13/-	" "	"B" Ord.	5/-	18/8
Arnott & Harrison, Ltd.....	Ord.	4/-	9/-	Jones (A. A.) & Shipman, Ltd.....	Ord.	5/-	27/6
Aaquist Machine Tool Corp., Ltd....	Ord.	5/-	9/6		7% Cum. Prf.	5/-	4/9
Birmingham Small Arms Co., Ltd....	6% Cum. Prf.	£1	16/6	Kearney & Tracker-C.V.A., Ltd.....	5% Red.	£1	10/-
	Ord.	10/-	23/6		Cum. Prf.		
" " "	5% Cum.	£1	14/-	Kearns (H. W.) & Co., Ltd.....	Prfd. Ord.	£1	13/9
" " "	"A" Prf.	£1	16/-	Kerry's (Gt. Britain), Ltd.....	Ord.	5/-	22/-
" " "	6% Cum.	£1	16/-		Ord.	5/-	9/-
" " "	"B" Prf.			Macredys Metal Co., Ltd.....	Ord.	5/-	16/6
" " "	4% 1st Mort.	Stk.	92½	Martin Bros. (Machinery), Ltd.....	Ord.	2/-	2/6
British Oxygen Co., Ltd.....	Deb.			Massey (B. & S.), Ltd.....	Ord.	5/-	10/-
	Ord.	5/-	20/-	Newall Engineering Co., Ltd.....	Ord.	2/-	7/6
Brooke Tool Manufacturing Co., Ltd....	6% Cum. Prf.	£1	19/-	Newman Industries, Ltd.....	Ord.	2/-	7/-
Broom & Wade, Ltd.....	Ord.	5/-	8/10½		6% Prf. Ord.	5/-	5/-
	Ord.	5/-	24/9	Noble & Lund, Ltd.....	Ord.	2/-	6/-xd
Brown (David) Corporation, Ltd.....	6% Cum. Prf.	£1	16/6	Norton, W. E. (Holdings), Ltd.....	Ord.	2/-	8/6
Buck & Hickman, Ltd.....	5½% Cum. Prf.	£1	15/-	Osborn (Samuel) & Co., Ltd.....	Ord.	5/-	49/6
Butler Machine Tool Co., Ltd.....	6% Cum. Prf.	£1	17/-		Ord.	5/-	22/-
	Ord.	5/-	15/-	Pratt (F.) & Co., Ltd.....	Ord.	5/-	17/9
Churchill (Charles) & Co., Ltd.....	5% Cum. Prf.	£1	12/6	Sanderson Kayser, Ltd.....	Ord.	10/-	29/4½
	Ord.	2/-	9/3		6½% Cum. Prf.	£1	16/3
Clarkson (Engrs.), Ltd.....	6% Cum. Prf.	£1	25/7½	Scottish Machine Tool Corporation, Ltd.	Ord.	4/-	9/-
	Ord.	5/-	7/6	Shardlow (Ambrose) & Co., Ltd.....	Ord.	£1	60/-
Cohan (George), 600 Group, Ltd.....	Ord.	5/-	ex capt.	Shaw (John) & Sons, Wolverhampton, Ltd.	Ord.	5/-	15/7½
	4½% Cum. Prf.	£1	11/6	Sheffield Twist Drill & Steel Co., Ltd.	Ord.	4/-	19/3
Coventry Gauge & Tool Co., Ltd.....	Ord.	10/-	29/4½		5% Cum. Prf.	£1	13/3
" " "	5% Cum.	£1	16/3	Stedall & Co., Ltd.....	Ord.	5/-	7/3
Craven Bros. (Manchester), Ltd.....	Ord.	5/-	9/14	Sykes (W. E.), Ltd.....	"B" non-voting Ord.	10/-	28/9
Elliott (B.) & Co., Ltd.....	Ord.	1/-	2/6	Tap & Die Corporation, Ltd.....	Ord.	5/-	16/3
" " "	4½% Red.	£1	12/-	" " "	4½% Deb.	Stk.	82½
	Cum. Prf.			Wadkin, Ltd.....	Ord.	10/-	26/-
Firth Brown Tools, Ltd.....	4% Cum. Prf.	£1	10/-	Ward (Thos. W.), Ltd.....	Ord.	£1	73/9
Greenwood & Batley, Ltd.....	Ord.	10/-	20/1½	" "	5% Cum.	£1	13/6
Harper (John) & Co., Ltd.....	Ord.	5/-	7/-	" "	1st Prf.		
" " "	4½% Red.	£1	11/7½	" "	5% Cum.	£1	20/-
	Cum. Prf.			Willson Lathes, Ltd.....	2nd Prf.	Ord.	3/-

The Middle Prices given in the list are in several cases nominal prices only and not actual dealing prices. Every effort is made to ensure accuracy, but no liability can be accepted for any error.

* Sheffield price.

† Birmingham price.

BRITISH MACHINE TOOL EXPORTS OF NEW MACHINE TOOLS

Countries	Bar and Chucking Automatics		Vertical Boring Machines		Other Boring Machines		Drilling Machines		Gear-cutting Machines		Grinding, Lapping and Honing Machines		Capstan and Turret Lathes		Other Lathes	
	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £
<i>Commonwealth</i>																
South Africa	—	—	—	—	189 (1)	7,738	239 (21)	6,201	—	—	79 (16)	4,182	535 (10)	23,238	531 (16)	21,153
India	—	—	1,098 (1)	60,754	150 (5)	7,818	435 (5)	7,659	—	—	1,147 (39)	47,554	1,349 (14)	38,287	469 (5)	19,600
Pakistan	—	—	—	—	379 (3)	11,334	146 (3)	5,501	—	—	15 (2)	554	49 (2)	3,120	—	—
Australia	519 (5)	22,520	—	—	666 (4)	21,773	1,351 (52)	41,188	308 (15)	4,204	1,027 (21)	47,393	1,494 (38)	60,617	1,857 (83)	81,946
New Zealand	91 (1)	7,353	130 (1)	10,142	—	—	328 (18)	8,190	—	—	43 (6)	1,452	201 (5)	8,819	685 (39)	21,977
Canada	—	—	115 (1)	5,869	—	—	453 (9)	6,533	—	—	205 (10)	8,471	117 (2)	6,488	1,020 (5)	25,522
Miscellaneous.....	—	—	—	—	2 (1)	676	218 (39)	7,916	—	—	72 (24)	2,159	107 (4)	2,932	654 (28)	20,873
<i>Foreign</i>																
Soviet Union	—	—	157 (2)	20,112	—	—	42 (1)	4,050	67 (3)	6,235	110 (2)	9,952	—	—	—	—
Sweden	—	—	—	—	127 (2)	9,779	34 (3)	1,390	—	—	304 (13)	8,031	373 (9)	16,124	161 (27)	7,357
Norway	—	—	—	—	—	—	40 (1)	1,180	—	—	2 (1)	110	—	—	61 (3)	1,900
Denmark	—	—	—	—	—	—	195 (3)	5,496	—	—	—	—	55 (3)	2,925	20 (12)	809
Western Germany	188 (2)	12,479	—	—	417 (1)	3,100	38 (24)	745	—	—	346 (15)	20,234	45 (1)	1,483	856 (46)	37,179
Netherlands	—	—	—	—	30 (2)	560	195 (10)	7,278	—	—	43 (6)	2,728	452 (7)	21,565	100 (27)	3,362
Belgium	—	—	—	—	—	—	218 (9)	3,573	—	—	217 (7)	7,121	87 (2)	5,444	247 (9)	4,967
France	120 (3)	6,597	—	—	50 (2)	2,977	5 (3)	542	—	—	324 (8)	13,105	454 (7)	22,498	225 (4)	10,100
Switzerland	—	—	—	—	—	—	122 (5)	5,025	—	—	37 (4)	3,276	109 (3)	7,625	342 (16)	12,408
Spain	—	—	—	—	—	—	13 (1)	637	798 (7)	51,618	233 (4)	22,178	233 (3)	11,697	12 (1)	500
Italy	1,016 (6)	69,682	—	—	34 (3)	4,399	6 (2)	887	115 (1)	7,951	46 (4)	3,182	56 (2)	2,543	18 (1)	1,072
US America	409 (2)	20,381	—	—	6 (1)	282	38 (2)	1,833	—	—	169 (13)	10,378	52 (2)	3,005	600 (25)	26,181
Miscellaneous.....	270 (4)	27,083	949 (7)	36,126	430 (6)	23,641	1,414 (100)	31,799	401 (6)	38,419	1,434 (92)	87,075	953 (13)	54,138	1,199 (76)	50,698
Total.....	2,613 (23)	166,095	2,449 (12)	133,003	2,480 (31)	94,077	5,530 (311)	147,623	1,689 (32)	108,427	5,853 (287)	299,135	6,721 (127)	292,548	9,057 (423)	347,604

Total exports of reconditioned machine tools:—Quantity, No. 199; Weight, 14,662 cwt.; Value, £115,470.
Total exports of imported machine tools:—Quantity, Weight 3,258 cwt.; Value, £47,640.

IMPORTS OF NEW MACHINE TOOLS

Country of Origin	Bar and Chucking Automatics		Vertical Boring Machines		Other Boring Machines		Drilling Machines		Gear-cutting Machines		Grinding, Lapping and Honing Machines		Capstan and Turret Lathes		Other Lathes	
	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £
Sweden	—	—	—	—	12 (1)	1,538	39 (6)	898	—	—	1,386 (11)	85,606	—	—	1,018 (6)	42,164
Western Germany	735 (8)	35,438	467 (2)	24,780	1,649 (5)	52,518	124 (10)	8,708	601 (5)	31,855	1,423 (64)	79,990	632 (21)	50,476	2,399 (51)	83,311
France	—	—	34 (2)	8,337	—	—	64 (3)	2,613	—	—	325 (5)	32,564	—	—	555 (8)	27,287
Switzerland	258 (13)	24,171	356 (6)	28,461	—	—	29 (14)	2,496	56 (3)	4,751	107 (10)	13,503	523 (17)	44,404	407 (12)	31,463
US America	227 (3)	23,130	90 (2)	4,597	—	—	130 (6)	20,036	2,411 (15)	155,290	2,463 (31)	185,441	842 (4)	70,932	170 (8)	3,896
Miscellaneous.....	20 (2)	682	—	—	572 (5)	17,057	383 (5)	9,976	—	—	634 (32)	28,730	103 (3)	3,176	569 (78)	28,899
Total.....	1,240 (26)	83,421	947 (12)	66,175	2,233 (11)	71,113	769 (44)	44,727	3,068 (22)	191,896	6,338 (153)	425,834	2,100 (45)	168,988	5,118 (158)	217,020

Total imports of reconditioned machine tools:—Quantity, No. 61; Weight, 4,208 cwt.; Value, £98,895.

IMPORTS AND EXPORTS (Classified)

and Parts during March, 1961

Value £	Milling Machines		Presses		Sheet-metal Working Machines		Sawing Machines		Screwing and Threading Machines		Planing, Shaping and Slotting Machines		Unit Transfer Machines and Heads		Other Machines		Machine Tool Parts*		Total	
	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £
1,153	125 (4)	6,038	1,742 (14)	35,081	330 (15)	10,243	63 (12)	2,068	11 (2)	714	176 (7)	4,595	—	—	811 (34)	17,242	428	22,841	5,259 (152)	161,334
9,600	710 (13)	19,262	1,112 (13)	34,771	1,026 (4)	27,064	25 (2)	670	101 (3)	6,922	527 (4)	18,661	—	—	769 (6)	11,387	640	31,583	9,558 (104)	331,992
—	78 (5)	6,367	201 (2)	4,347	—	—	—	—	37 (1)	1,232	—	—	—	—	—	—	87	4,859	992 (18)	37,314
1,946	152 (27)	49,407	3,124 (7)	70,569	724 (4)	15,772	14 (2)	418	59 (4)	1,873	367 (13)	10,933	4 (10)	747	783 (13)	29,116	1,294	61,232	14,743 (298)	519,708
1,977	87 (2)	1,853	194 (6)	4,063	369 (5)	8,723	31 (6)	791	—	—	70 (4)	5,512	—	—	156 (5)	4,116	58	5,355	2,443 (98)	88,346
15,522	806 (6)	45,844	196 (2)	1,437	—	—	—	—	—	—	1,029 (2)	20,109	—	—	20 (1)	2,207	4,221	74,990	8,182 (38)	197,470
10,873	125 (7)	5,708	800 (10)	19,057	170 (13)	2,878	150 (31)	4,932	2 (1)	50	48 (5)	1,243	—	—	45 (10)	1,904	219	16,142	2,612 (173)	86,470
—	—	—	—	399 (7)	36,923	14 (2)	1,910	—	—	—	—	—	—	—	—	—	2	62	791 (17)	79,244
7,357	723 (5)	20,830	—	—	448 (9)	32,207	—	—	21 (1)	1,800	—	—	—	—	54 (3)	1,434	651	30,045	2,896 (72)	128,997
1,900	—	—	—	—	—	—	2 (1)	54	5 (2)	505	—	—	—	—	—	—	12	1,067	122 (8)	4,816
809	—	—	1,260 (4)	29,034	—	—	—	—	—	—	—	—	—	—	488 (1)	13,828	30	3,140	2,048 (23)	55,232
17,079	351 (4)	17,675	52 (1)	670	92 (2)	7,609	9 (2)	1,768	155 (2)	10,541	2 (6)	140	—	—	717 (12)	27,310	422	16,593	3,690 (118)	157,526
3,362	60 (3)	6,347	130 (2)	5,751	4 (5)	159	—	—	—	—	8 (2)	372	—	—	4 (8)	850	92	9,488	1,118 (72)	58,460
4,967	280 (1)	11,840	7 (1)	355	278 (2)	7,906	—	—	—	—	—	—	—	—	182 (2)	12,051	22	2,529	1,458 (33)	55,786
10,100	180 (1)	9,162	205 (8)	6,845	—	—	—	—	—	—	40 (1)	1,072	—	—	648 (8)	25,436	82	9,540	2,333 (45)	107,874
2,408	121 (57)	6,463	200 (1)	6,020	—	—	—	—	—	—	6 (1)	163	—	—	—	—	79	6,055	1,016 (87)	47,035
500	17 (1)	1,055	1,381 (1)	36,119	36 (2)	1,012	—	—	—	—	—	—	—	—	172 (1)	4,840	12	2,452	2,907 (21)	132,108
1,072	120 (1)	8,156	39 (20)	2,000	181 (3)	13,921	—	—	—	—	40 (1)	1,600	—	—	449 (8)	43,292	184	23,624	2,304 (52)	182,309
16,181	48 (2)	1,792	—	—	14 (6)	370	—	—	133 (4)	10,433	64 (2)	2,139	1 (3)	187	116 (4)	7,812	187	13,071	1,837 (66)	97,864
50,698	1,999 (28)	63,741	531 (39)	29,048	380 (28)	10,569	53 (6)	1,613	55 (9)	5,419	832 (27)	29,077	—	—	545 (62)	19,612	1,124	42,266	11,769 (503)	550,324
947,604	6,022 (157)	281,540	11,174 (131)	285,167	4,451 (105)	175,356	361 (64)	14,224	579 (29)	39,489	3,209 (75)	95,616	5 (13)	934	5,959 (178)	222,437	9,846	376,934	78,078 (1,998)	3,080,209

Figures in parentheses denote number of machines.

* Not including machine tool cutting parts.

Imports and Parts during March, 1961

Value £	Milling Machines		Presses		Sheet-metal Working Machines		Sawing Machines		Screwing and Threading Machines		Planing, Shaping and Slotting Machines		Unit Transfer Machines and Heads		Other Machines		Machine Tool Parts*		Total	
	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £	Quantity, Cwt. and No.	Value £
42,164	304 (8)	13,846	—	—	77 (3)	1,738	—	—	—	—	13 (10)	863	—	—	1 (3)	453	84	5,344	2,934 (48)	152,450
33,311	596 (16)	56,660	3,112 (27)	74,469	464 (42)	22,729	335 (58)	10,790	561 (22)	29,517	1,646 (10)	63,718	—	—	3,668 (45)	124,906	528	45,565	18,962 (386)	795,430
27,287	865 (16)	44,795	315 (5)	15,011	242 (12)	5,597	8 (1)	372	—	—	—	—	—	—	726 (19)	23,144	128	9,978	3,262 (71)	169,698
31,463	564 (11)	27,647	733 (7)	33,309	—	—	—	—	—	—	17 (3)	1,910	—	—	141 (23)	14,105	180	27,237	3,371 (118)	253,457
3,896	1,363 (19)	84,606	1,047 (9)	70,943	353 (25)	15,568	8 (1)	731	165 (29)	16,576	2 (1)	325	322 (1)	48,897	3,677 (36)	96,460	1,673	203,356	15,143 (190)	1,000,784
28,899	1,349 (36)	36,373	1,681 (34)	24,199	204 (13)	5,174	38 (5)	1,456	94 (1)	4,989	105 (2)	8,933	—	—	79 (11)	6,894	335	23,064	6,166 (222)	199,602
217,020	5,243 (106)	263,927	6,888 (82)	217,931	1,360 (95)	50,806	389 (65)	13,349	820 (52)	51,082	1,783 (26)	75,749	322 (1)	48,897	8,292 (137)	265,962	2,928	314,544	49,838 (1,035)	2,571,421

Figures in parentheses denote number of machines.

* Not including machine tool cutting parts.

PRICES OF MATERIALS

All prices per ton except where otherwise stated.

Pig Iron*

Foundry and Forge

No. 3, Class 2

Middlesbrough (10 tons or over)	£21 17 0
Birmingham (10 tons or over)	£21 9 3

Phos. Over 0.1 up to 0.4%

Birmingham (6 ton lots)	£23 5 0
Grangemouth (6 ton lots)	£23 10 0

Haematite

English No. 1 (10 tons or over)

N.E. Coast (made in N.E.)	£23 19 0
Scotland (made in Scotland, zone S.I.)	£24 5 6
Sheffield	£25 9 0
Birmingham	£25 13 0

Welsh 10 tons or over

	£23 19 0
--	----------

Steel Products*

Medium plates (50 tons and over)

Mild steel plates, ordinary	£43 16 6
-----------------------------	----------

Boiler plates (50 tons and over)

Flat bars, 5 in. wide and under	£42 17 0
---------------------------------	----------

Round bars, under 3 in. (50 tons or over)

Billies, rolling quality, soft U.T.	£39 1 0
-------------------------------------	---------

(100 tons or over)

	£31 15 6
--	----------

Phosphor Bronze

Ingot (288) (A.I.D.) d/d	£315 0 0
--------------------------	----------

Copper

Cash (mean)	£230 7 6
-------------	----------

Cold rolled and hot rolled sheets

4 ft. by 2 ft. by 10 SWG	£306 10 0—£306 15 0
--------------------------	---------------------

Rods, ½ in. to ½ in. diam.

Tubes, ½ in. bore by 10 SWG,	£321 10 0
------------------------------	-----------

ton lots, per lb.

Wire rod, black, hot-rolled	3s. 1½d.
-----------------------------	----------

(½-½ in.), English

	£245 17 6
--	-----------

Zinc

Refined, minimum 98 per cent

purity, current month (mean)	£76 18 9
------------------------------	----------

Brass

Tubes, solid drawn, basis per lb.

Strip 63/37, 6in. by 10 SWG coils,	1s. 9½d.
------------------------------------	----------

ton lots

Rods, ½-½ in. diam. (59 per cent	£256 10 0—£259 10 0
----------------------------------	---------------------

copper)

	2s. 0½d.
--	----------

Yellow Metal

Condenser plates, per ton

Rods, per lb.	£186 0 0
---------------	----------

Aluminium

Ingot, min. 99.5 per cent	£186 0 0
---------------------------	----------

Canadian d/d

	£186 0 0
--	----------

Tinplates

**U.K. Home trade:

Cold reduced, f.o.r. makers,	
------------------------------	--

works (15-50 tons)

U.K. Export:	£3 6 8
--------------	--------

Hot rolled basis, f.o.r.

works port	73s. 6d.—76s. 0d.
------------	-------------------

Cold reduced basis, f.o.r.

works port	73s. 6d.—76s. 0d.
------------	-------------------

Gunmetal

Ingot, B.S. 1400 L.G.2, delivered

	£219 0 0
--	----------

*Subject to increase of 1%.

**Official maximum price, after allowing for

adjustments for increase in price of tin.

MAKERS' PRICES

Hexagon Steel Bars¹

Sizes in inches from 1 in. up to

2 ½ and 2 ½ a/f ex works,	
---------------------------	--

2 tons basis

Free cutting black	£42 17 6†
--------------------	-----------

Reeled Steel Bars¹

Single-reeled, ½ in. upwards,

f.o.t. works (+ usual extra	
-----------------------------	--

for sizes)

Free cutting	£43 9 0†
--------------	----------

Free cutting

	£47 7 0†
--	----------

Precision-ground Mild Steel¹

1-in. diam. ± 0.00025-in.

4-ton lots, per cwt.	124s. 6d.†
----------------------	------------

Bright Ground Stainless

Steel Bars¹

EN56AM (martensitic, free cutting)

	£304 10 0
--	-----------

EN58AM (austenitic free cutting)

	£377 10 0
--	-----------

Prices are basic, subject to extras.

High-speed Steel

Black random length bar. All prices basic,

½ per lb., subject to extras:	
-------------------------------	--

Molybdenum "66"

	6s. 5d.
--	---------

Molybdenum "46"

	6s. 3d.
--	---------

14 per cent tungsten

	6s. 11d.
--	----------

16 per cent tungsten

	7s. 4d.
--	---------

18 per cent tungsten

	7s. 9d.
--	---------

22 per cent tungsten

	9s. 2d.
--	---------

5 per cent cobalt

	10s. 10d.
--	-----------

4.75/5.25 molybdenum

+ 6.0/6.75 tungsten +	
-----------------------	--

1.75/2.05 vanadium per cent

(5-6-2)	6s. 7d.
---------	---------

Precision-ground, High-speed

Free-turning Brass Rod¹

½-in. diam. ± 0.00025-in., 2 ton

lots, per lb.	2s. 7½d.
---------------	----------

Grey Iron Rod

Die Cast¹ in random lengths 18 in. to

26 in. rough machined ½ in. above listed	
--	--

size. Extra for definite lengths. Dis-

counts for orders over £150.	
------------------------------	--

Per cwt. net.

Mark I	Mark III
--------	----------

½ or ¾ in.

260s. 3d.	338s. 3d.
-----------	-----------

1 or 1 ½ in.

208s. 4d.	267s. 3d.
-----------	-----------

1 ½ to 1 ¾ in.

146s. 3d.	181s. 7d.
-----------	-----------

1 ¾ to 2 in.

112s. 7d.	133s. 6d.
-----------	-----------

2 to 2 ¼ in.

97s. 1d.	112s. 9d.
----------	-----------

2 ¼ to 3 in.

91s. 9d.	105s. 3d.
----------	-----------

Continuous Cast

10-ft. lengths, centreless machined 1 to 3-in.

diam. + 0.010 to 0.020 in., prices as	
---------------------------------------	--

quoted for die cast bar¹

centreless ground 1 or 1 ½ in.	208s. 4d.
--------------------------------	-----------

+ 0.010 in. Extra

for hardenable	1 ½ to 1 ¾ in. 146s. 3d.
----------------	--------------------------

alloy iron¹

1 ¾ in. to 2 in.	112s. 7d.
------------------	-----------

Per cwt. net

2 ¼ to 3 in.	97s. 1d.
--------------	----------

Stellite¹

Welding Rods, plain

½ in. diam., per lb.	30s. 0d.
----------------------	----------

Toolbits

½ in. sq. x ¼ in., each

	22s. 3d.
--	----------

1 Colvilles, Ltd., Glasgow, and 17 Grosvenor

Street, London, W.V.I. 2 Pratt, Levick & Co.,	
---	--

Ltd., Chester. 3 Spartan Steel & Alloys, Ltd.,

St. Stephens Street, Birmingham, 6. 4 Sheep-	
--	--

bridge Alloy Castings, Ltd., Sutton-in-Ash-

field. 6 "Flocast," Harold Andrews Sheep-	
---	--

bridge, Ltd., Malesowen. 8 Daloro Stellite,

Ltd., Highlands Road, Shirley, Solihull.	
--	--

† Plus 1 per cent.

BASIC PRICES FROM

LONDON STOCK¹

Free Cutting Steel

Bright cold drawn:

(Usaspeed) over 1 to 2 in.	£59 4 6†
----------------------------	----------

Lead bearing (Usaled)

Precision ground, 1 ½ in.	£63 11 0†
---------------------------	-----------

Precision ground, 1 ½ in.

	£84 14 6†
--	-----------

Bright Drawn

M.S. bars (M.M.C.) over 1 ½

to 2 in.	£56 10 0†
----------	-----------

Square edge flats (Usafat)

M.S. angles (Usaspeed)	£73 6 6†
------------------------	----------

M.S. angles (Usaspeed)

Case hardening (EN) (Usacase)	£100 6 6†
-------------------------------	-----------

over 1 ½ to 2 in.

	£62 10 0†
--	-----------

M.S. bars (EN3B) (Usamild)

over 1 ½ to 2 in.	£58 16 6†
-------------------	-----------

Carbon manganese semi-free cutting

case hardening (EN202) (Usaspeed	
----------------------------------	--

202) over 1 ½ to 2 in.

	£71 5 0†
--	----------

35/45 ton tensile (EN6) (Usan)

over 1 to 1 ½ in.	£67 3 0†
-------------------	----------

0.4 carbon normalized (Usaspeed

"40") over 1 ½ to 2 in.	£69 5 0†
-------------------------	----------

0.45 carbon normalized EN9

(Usaspeed 55)	£69 15 0†
---------------	-----------

Carbon manganese steel to Specifi-

cation EN16T (Usaspeed	
------------------------	--

5545), per ton

	£126 17 0†
--	------------

Ground Flat Stock

18-, 24-, and 36-in. lengths (Usa-

speed). List prices plus 10 per cent,	
---------------------------------------	--

less 5 per cent.

Oil Hardening Cast Steel

Non-shrink (Usaspeed N.S.O.H.),

½ in. to 2 ¼ in., per lb.	1s. 11d.
---------------------------	----------

Non-distorting heavy duty

(Usaspeed H.C.H.C.), ½ in.	
----------------------------	--

to 2 ¼ in., per lb.

	4s. 2d.
--	---------

Silver Steel

(0-194-in. to 1 ½ in.)

Genuine Stubbs quality, per lb.	
---------------------------------	--

4s. 10d. less 27½%

M.M.C. quality, per lb.

	2s. 8d. + 6½%
--	---------------

Boxes of 16 assorted sizes, ½ in.

to ½ in. diam.	7s. 6d.
----------------	---------

Stainless Steel

KE40AM (free cutting), per lb.

	3s. 8d.
--	---------

Glacier Machined Bronze Bars

Phosphor bronze (288) }



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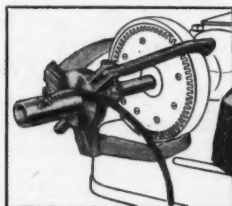
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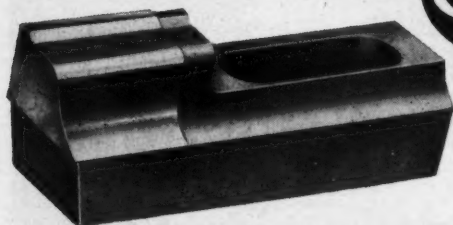
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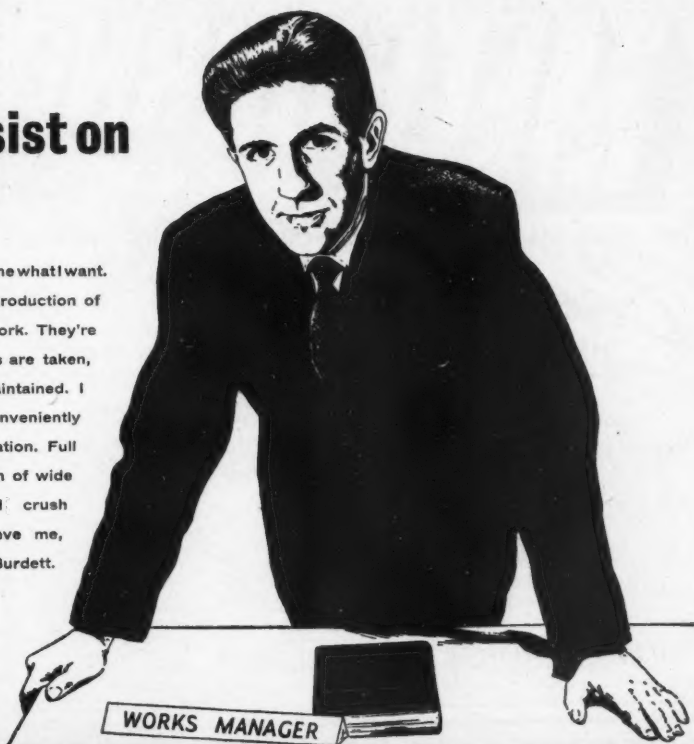
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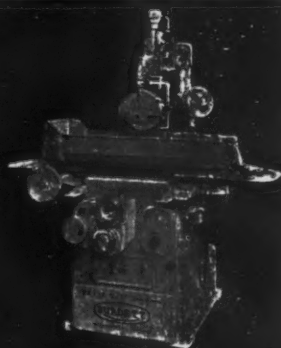
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Heavy cuts will not disturb the settings of the specially designed spindle and bearings. All working parts fully protected and serviced with ease.



MODEL 77. 24" x 12".

Latest addition to the range. Has all the features of the other models plus extra grinding width for dies and press tools.

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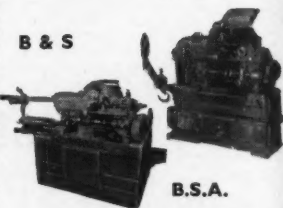


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at reasonable price

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E.G. 12in. by 3in. by 1½ in. ± 0.0002in.

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B.S.S. No. 906.

E.G. 12in. by 3in. by 1½ in. ± 0.0004in.

RANGE OF SIZE

4in. by ¾ in. by ¾ in.

6in. by 1in. by ¾ in.

6in. by ¾ in. by ¾ in.

8in. by ¾ in. by 1½ in.

9in. by 1in. by ¾ in.

10in. by 2in. by 1in.

12in. by 2in. by 1½ in.

12in. by 3in. by 1½ in.

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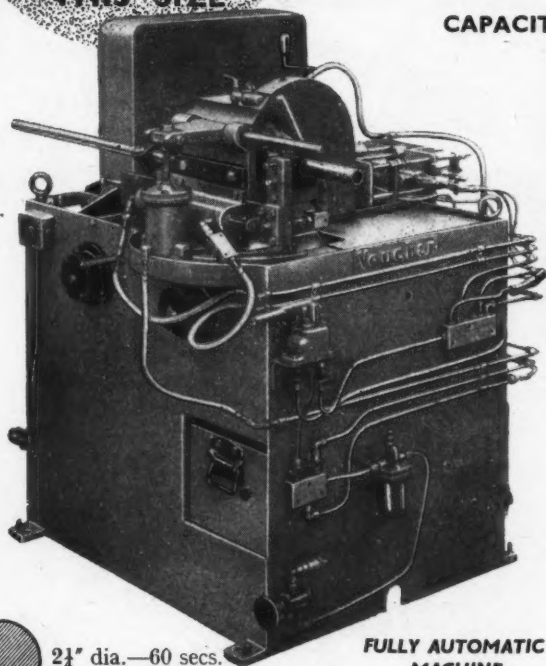
TO CUT A
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THIS SIZE

WITH THE

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**PNEUMATIC
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CAPACITY $2\frac{1}{2}$ " or 3" BARS OR TUBES



**FULLY AUTOMATIC
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$2\frac{1}{2}$ " dia.—60 secs.
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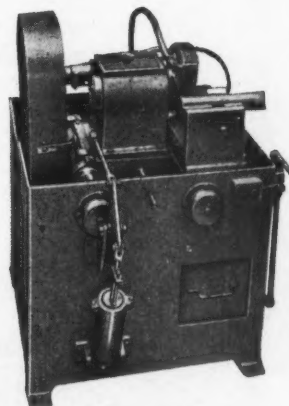
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$2" \times 2"$ —35 secs.
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We can also offer standard or special purpose machines for screwing or cutting-off or both. May we quote you?

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**SEMI-AUTOMATIC
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suitable for cutting long lengths and tubular bends.


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PROTECTIVE
COATING**




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The "Gloscoat" is a plastic protective packaging material for the protection of tools, machined parts and simple assemblies, and is applied by a simple dipping method. It is easily removed by peeling, leaving on the surface a thin film of lubricating oil.

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★ **REDUCES MAN-HOURS** It reduces packing time by at least 60% in Man Hours. ★ **RESISTS CORROSION, RUST,** etc. Adequate protection for the coated article against all forms of corrosion, rust, etc.

★ **PROTECTS FROM ROUGH HANDLING** Protection against abrasion, mishandling during transit. ★ **PROTECTS FROM HEAT AND COLD** Protection under all conditions. Particularly in hot, humid atmosphere or in extremes of cold.



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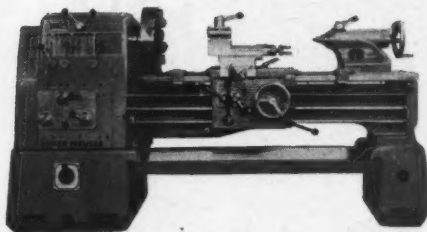
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Over 28,000 Meuser lathes of all sizes have been installed throughout the world. They are in operation in all classes of industry, as well as Scientific and Technical Institutes where versatility and reliability are of prime importance.

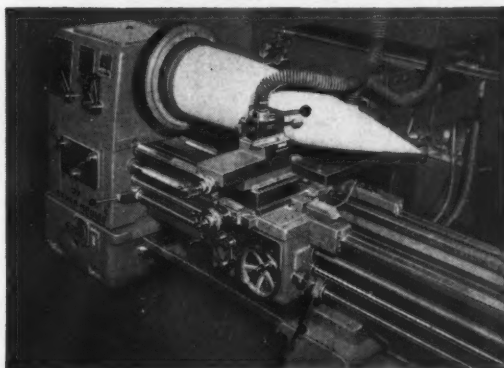
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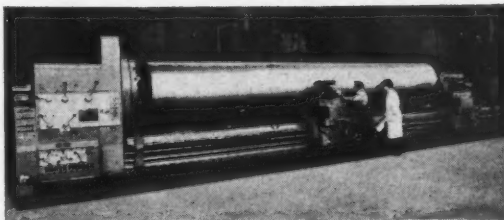
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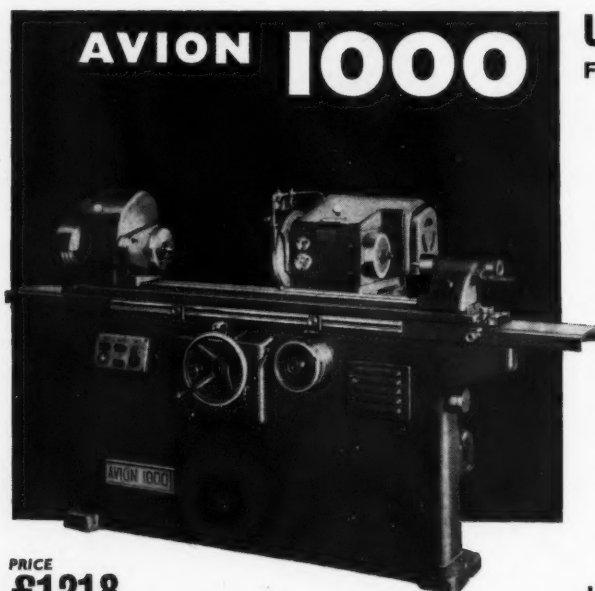
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PRICE

£1218

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FEATURES

This machine has been designed for high precision, ease of operation, long life and to cover a variety of jobs.

BASE—Made from a single casting, heavily ribbed for strength.

TABLE—Slides smoothly on one flat and one Vee way which are precision scraped.

WHEELHEAD—Constructed to swivel through 360°.

WORKHEAD—The hollow steel spindle is hardened and ground. Made to swivel through 360° with four speed adjustment.

MAIN SPECIFICATION

Distance between centres	.. ..	39½ in.
Maximum swing	.. ..	9½ in.
Size of table	.. ..	63 in. by 6 in.
Min. and max. wheel spindle speeds		1,900, 2,350 r.p.m.
Min. and max. work speed	.. ..	110, 280 r.p.m.
Wheel drive motor	.. ..	2 H.P.
Table drive motor	1 H.P.
Work head motor	0.3 H.P.
Morse Taper	No. 3
Approx. weight	3,100 lbs.

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- Backgeared Head 85-1,500 r.p.m. 6 speeds. • 5 speed Direct Drive, 375-2,250 r.p.m. available on Models 1, 2 and 3.
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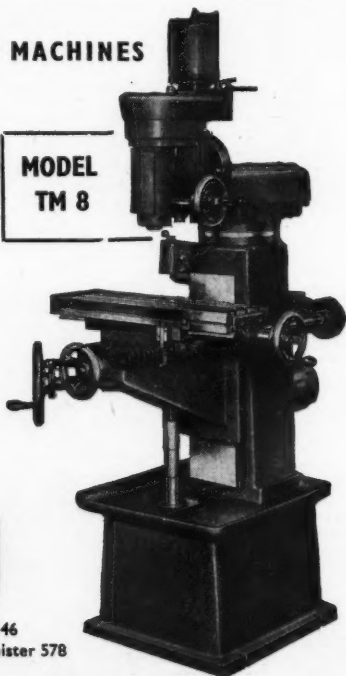
Model	Table	Table to Spindle
1	22 in. by 6½ in.	16 in.
2	28 in. by 6½ in.	16 in.
3	28 in. by 8 in.	15 in.
4	28 in. by 8 in.	19 in.
5	28 in. by 10 in.	19 in.

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Radial and Sliding Arm, Swivelling and Down Feed Head. Power Feed to table optional.

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T.M.10	28 in. by 10 in.	19 in.

MODEL
TM 8



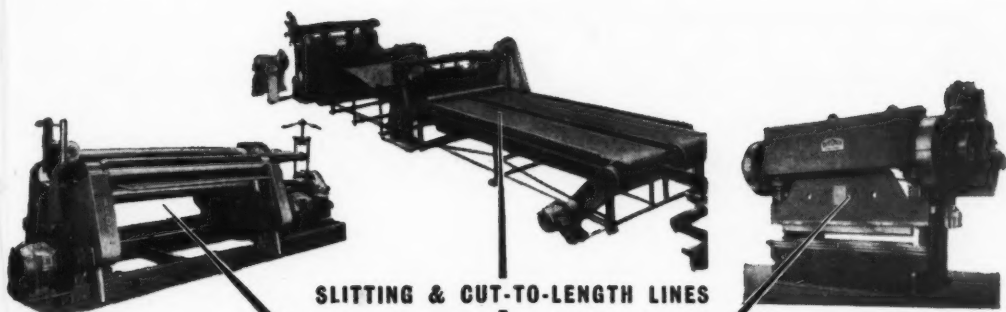
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Head Office THICKET CORNER · MAIDENHEAD · Phone 50.

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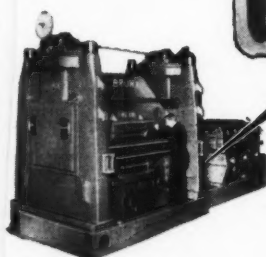
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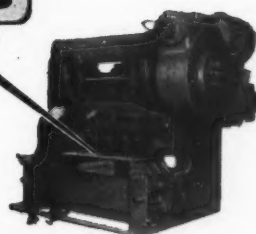


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Tube and Bar
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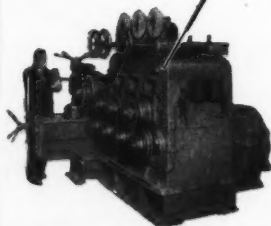
*Write for catalogues or ask
our Engineers to discuss
your problems*



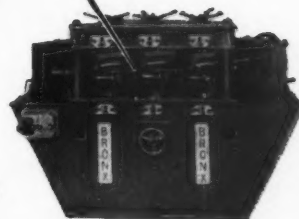
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**SECTION
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Telegrams: BRONX, LYE

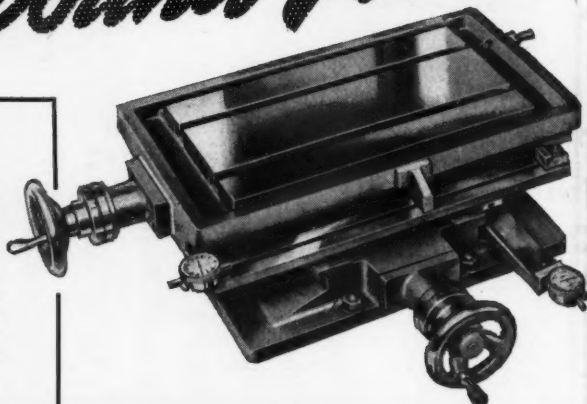
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The GRIMSTON No. 1 Compound Table, with its graduated micrometer hand-wheels and dial indicators, transforms the commonplace column or bench drilling machine into a machine tool capable of accurate jig drilling, etc. The model illustrated has a working area of 18" x 10", with a longitudinal travel of 13" and transverse movement of 6". The outstanding features of this table are its accuracy, its low over-all height of only 5½", and its reasonable cost. A larger No. 2 Table, movements 20" x 12" is also available.

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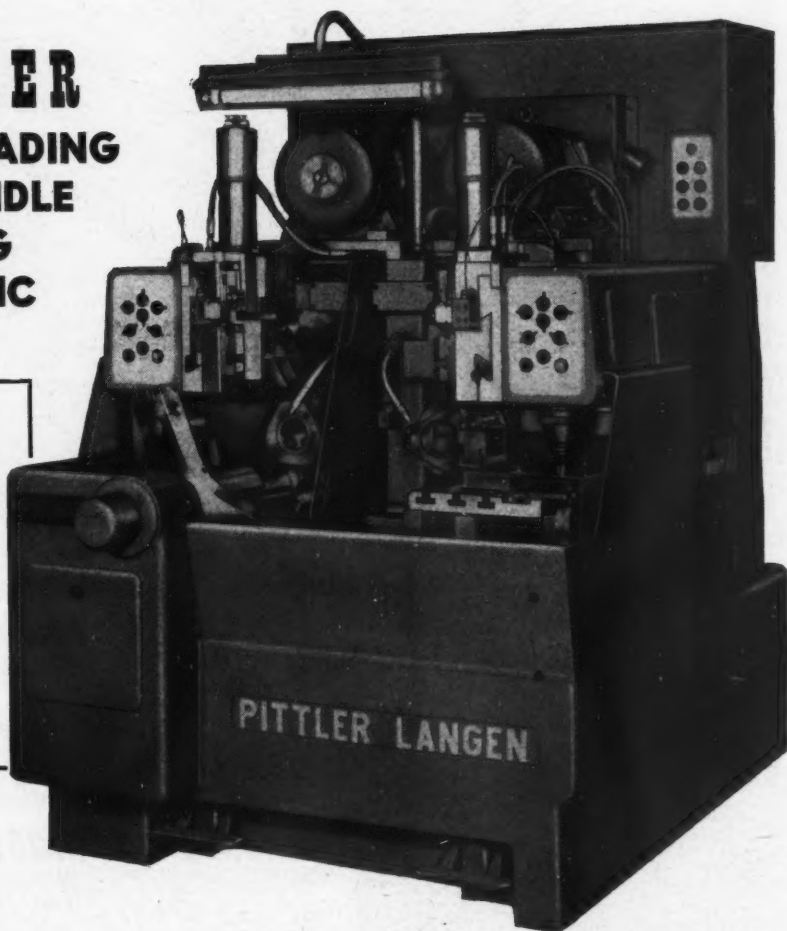
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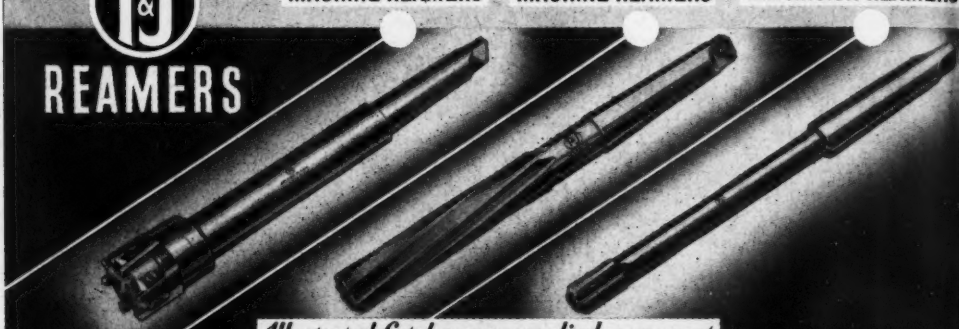


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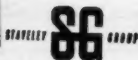
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CUTTING-OFF MACHINE

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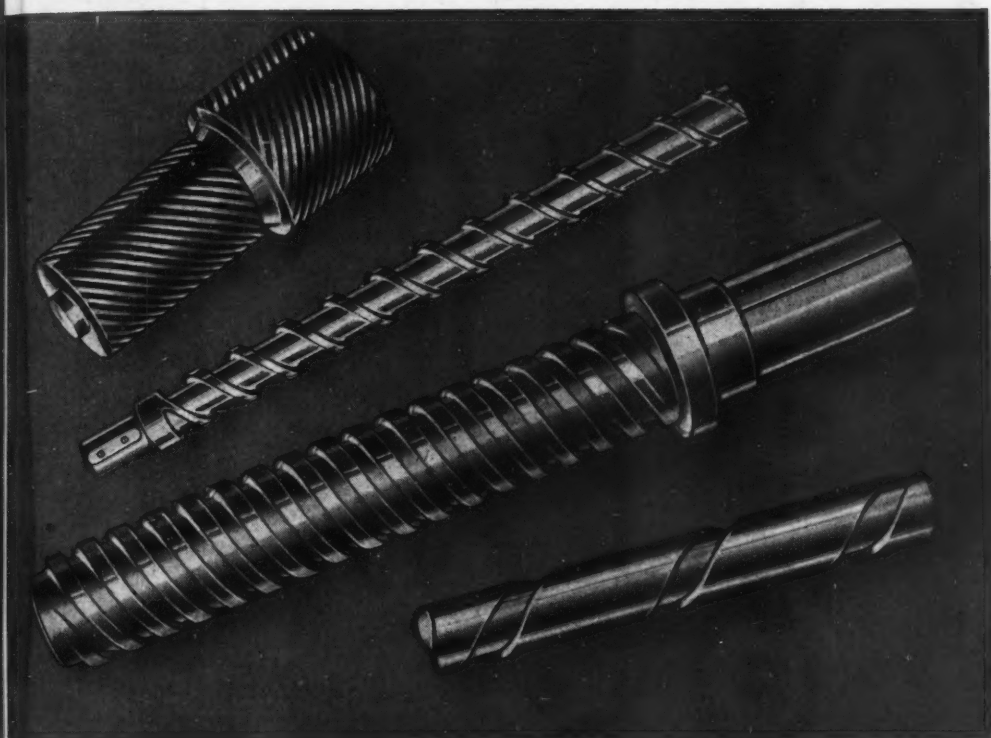
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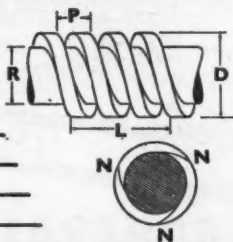


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SCREW THREADS ($\frac{3}{8}$ " dia. to 10" dia. : up to 30' long according to dia.) AND NUTS
—ALSO EXTRUDER SCREWS FOR THE PLASTICS INDUSTRY**

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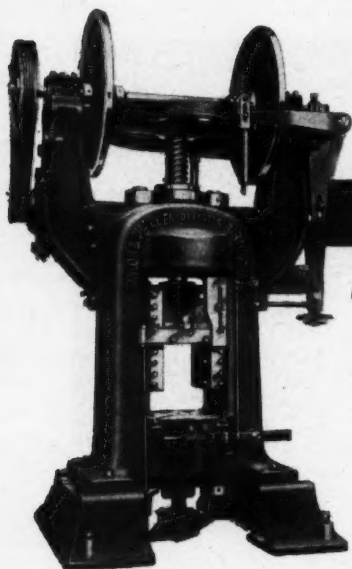
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HAND OF THREAD _____
PITCH (P) _____
LEAD (L) _____
No. OF STARTS (N) _____
OUTSIDE DIAMETER (D) _____
ROOT DIAMETER (R) _____
TYPE OF MATERIAL _____
PURPOSE _____



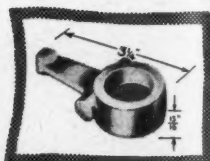
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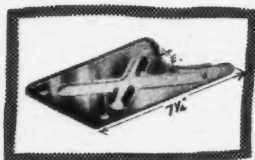
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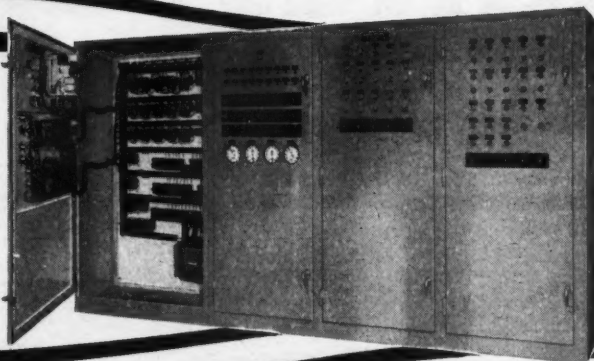
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Panel supplied in conjunction with I.G.E. MASTEROTOR for the control of Fully automatic BISCUIT PLANT

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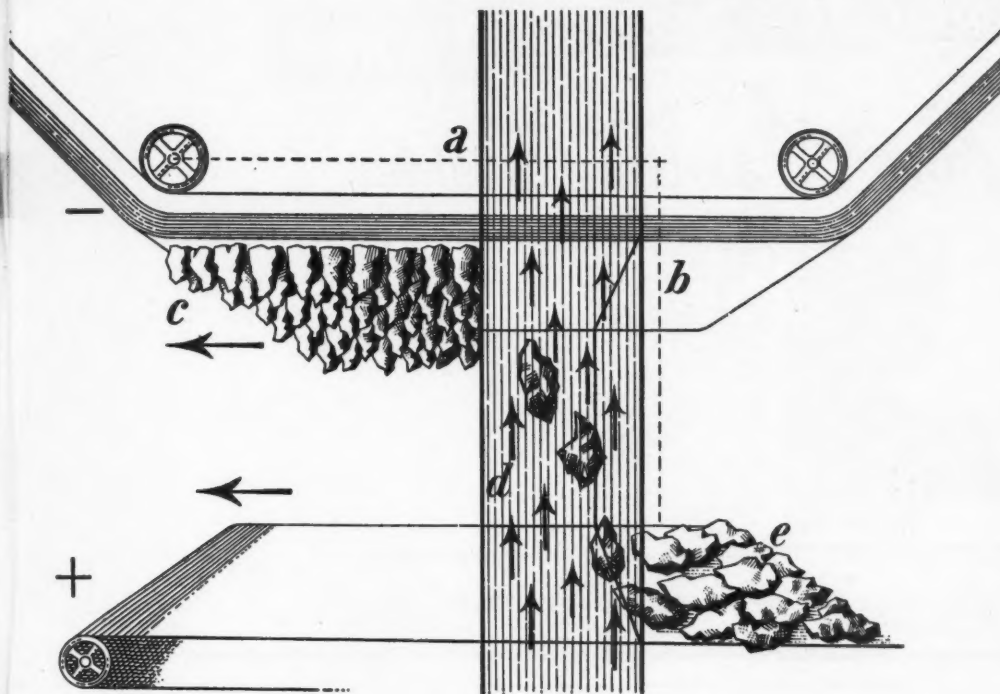
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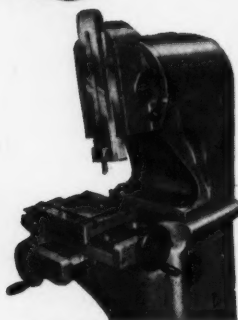
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Leytool 2-inch Stroke Slotting Machine



THE Leytool Slotting Machine is a development of necessity to provide economic manufacture of the 1001 small parts which no other machine can handle. So successful was this machine in their own works that the designers, The Leytonstone Jig and Tool Company, have now developed it to play an invaluable part in both small and large machine shops. Sturdy, well-built and comprehensive in its uses on production machining of small parts, this machine has accuracy, adaptability and unique features of the greatest possible value in the toolroom. A "great" little machine which in initial cost, production time and trouble-free service offers a 25% overall saving in manufacturing costs of any part.

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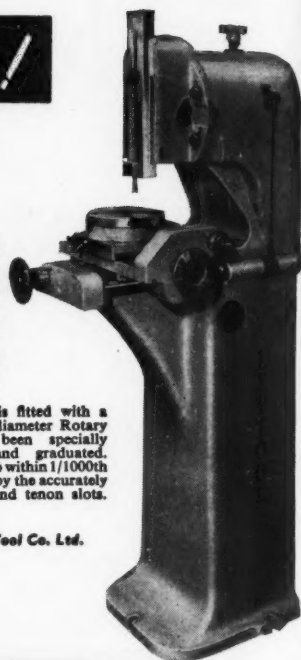
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Telephone: EGHAM 4166-7



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ILLUSTRATION SHOWS THE STANDARD
MODEL **CAPACITY 11" x 18"**
COMPLETE WITH FULLY MOTORISED
WORKHEAD

PRICE **£533**

... also available with capacity of
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grinding attachment, collet attachment,
dividing head, chucks, long surface grind-
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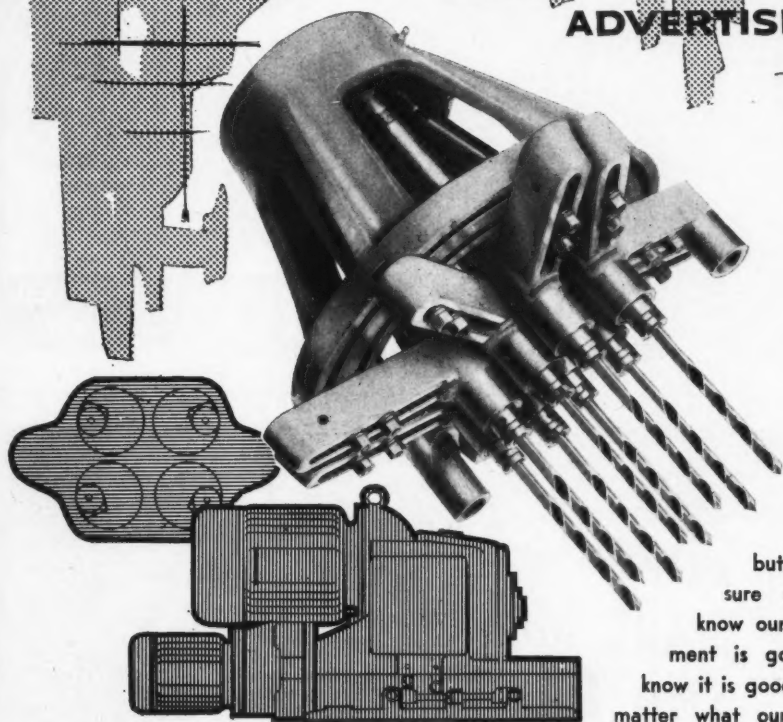
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THIS IS A GOOD
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but we're not so sure ourselves. We know our Drillmax Equipment is good and if you know it is good also—what's it matter what our artist thinks?

Drillmax Automatic Equipment includes a unique range of Standardised Units—Screw Feed, Cam and Hydraulic Unit Heads, Multi-drill Heads and Standard Drill Spindles and Gearing—Automatic Rotary Indexing Tables, Wing Bases, Columns, Loading and Unloading Mechanisms, etc., from which complete Automatic Rotary, Drum and In-line Transfer Special Purpose Machines can be built.

We invite you to visit our
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Peter Brasshouse Ltd., Drillmax Division, Leighswood Works, Leighswood Rd., Aldridge, Staffs. Tel.: ALDridge 52814-5

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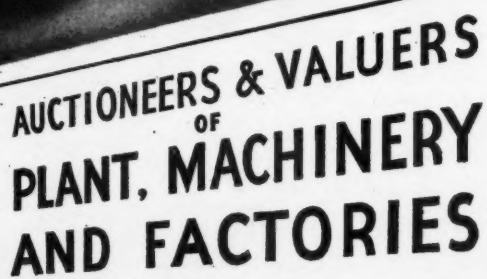
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Made in diameters from $\frac{1}{8}$ " to 10" with bores to suit, and any quantity, material, brass, or steel shim stock, in thicknesses between .002" and .06". Also laminated shims up to 6" dia. Tab washers and shims of irregular shapes can also be produced.

We shall be pleased to receive your enquiries.

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OF
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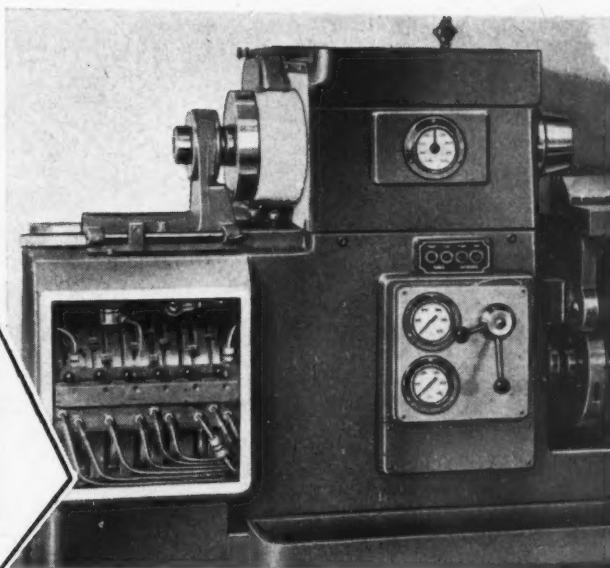
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for GREATER
FLEXIBILITY
— GREATER
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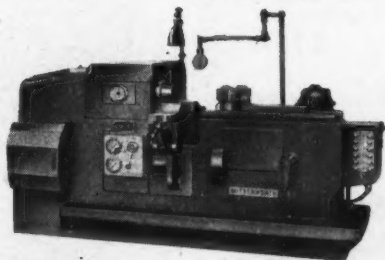
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cuts costs on short or long runs

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- NO SPECIAL CAMS

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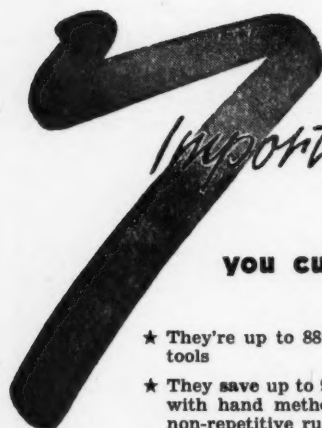


Also 3" Light Duty, 3" Standard, 3½" Standard.

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BUTTERWORTH
BRITISH AUTOMATIC MACHINE TOOL CO. LTD.
LINCOLN STREET, ROCHDALE

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CROSLAND

BLANK AND PIERCE DIES

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High Speed

drilling machines

ALL GEARED HEAD

Model A.59: 1½" Capacity.
8 Speeds from 100 to 1,280 r.p.m.
Spindle/Table maximum distance 31½". **£140**
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Exclusive Distributors in the United Kingdom.

GATE MACHINERY CO. LTD

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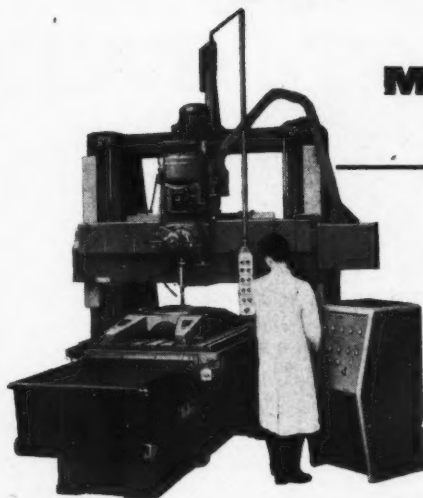


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See them in Action!

STAND N° 9115 - HALL 9

**7th EUROPEAN
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BRUSSELS 3-12 SEPT**



◀ **Tape controlled drilling**

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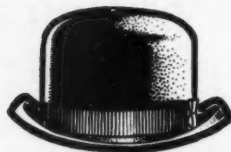


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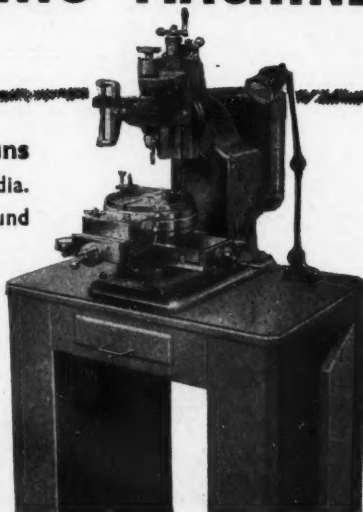
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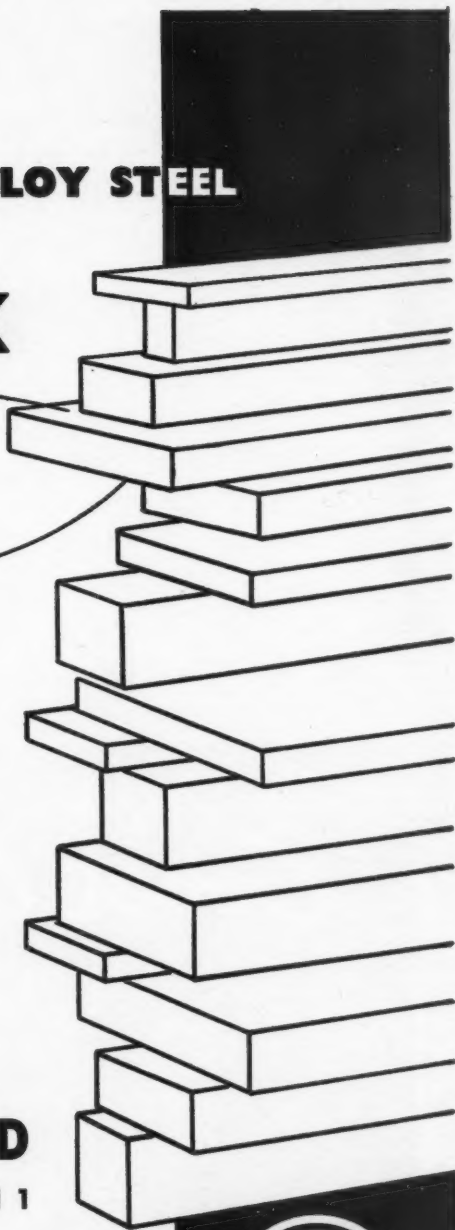
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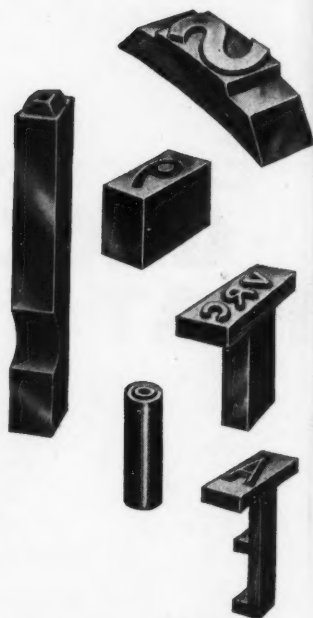
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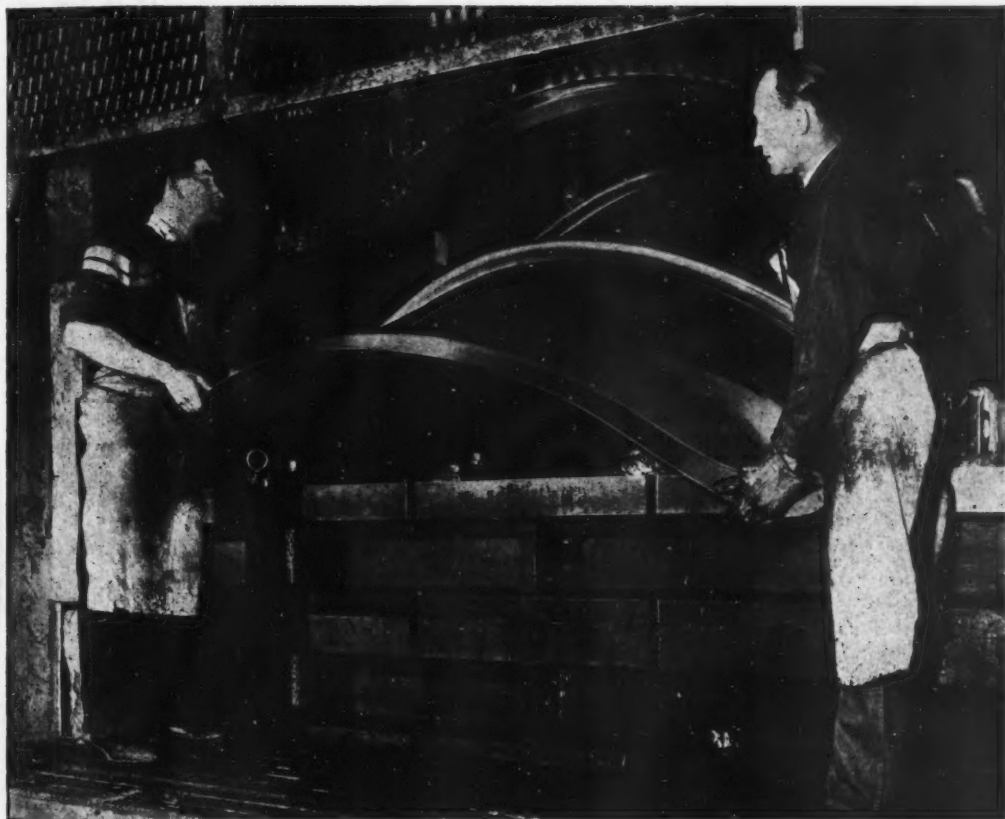
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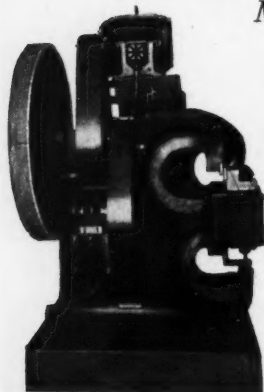
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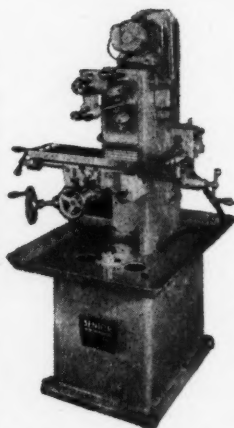
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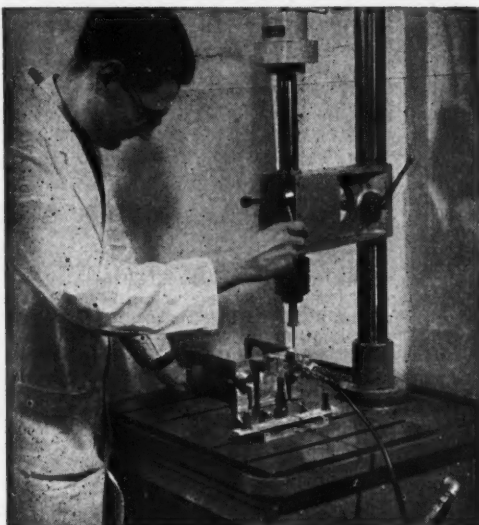
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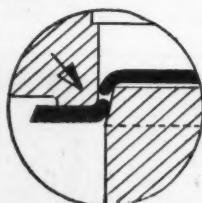
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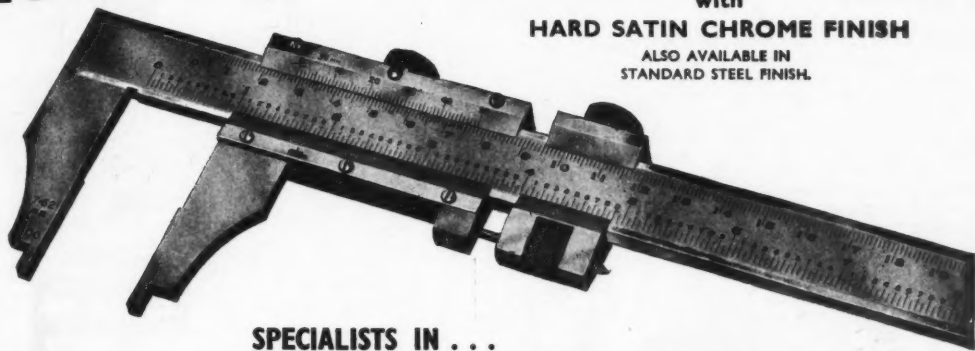
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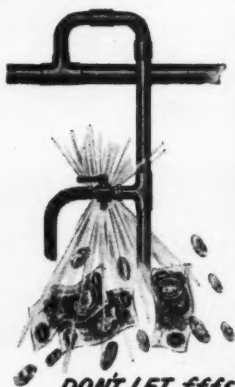
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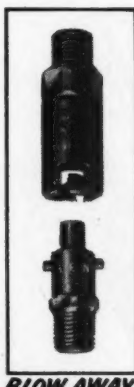
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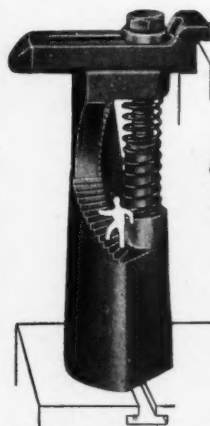
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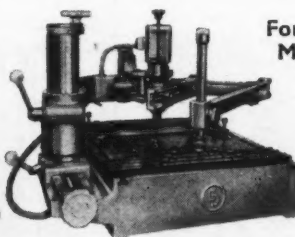
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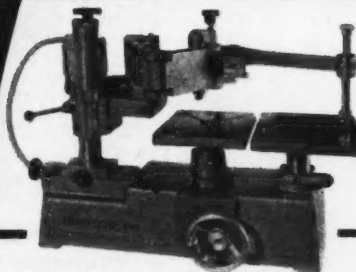
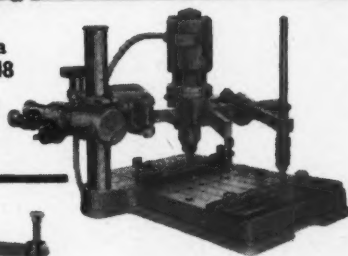


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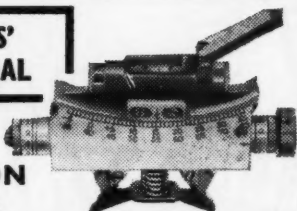
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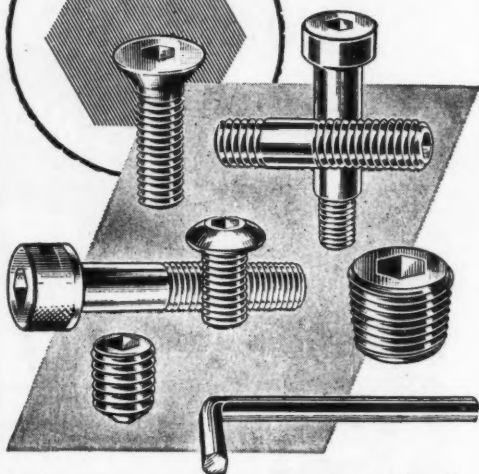
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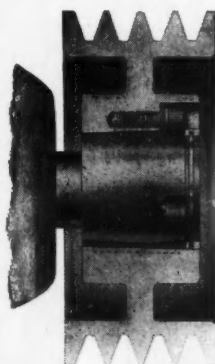
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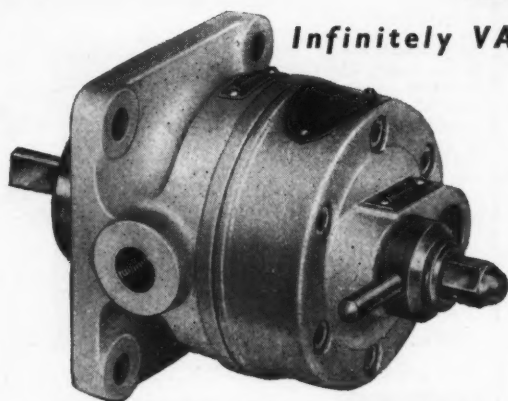
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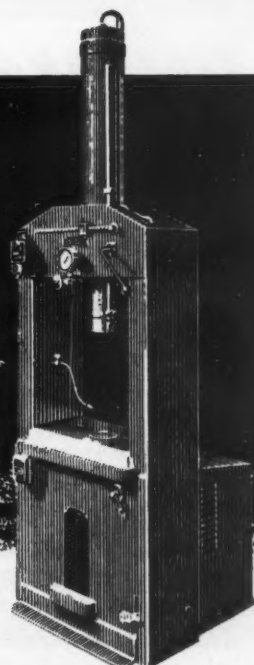
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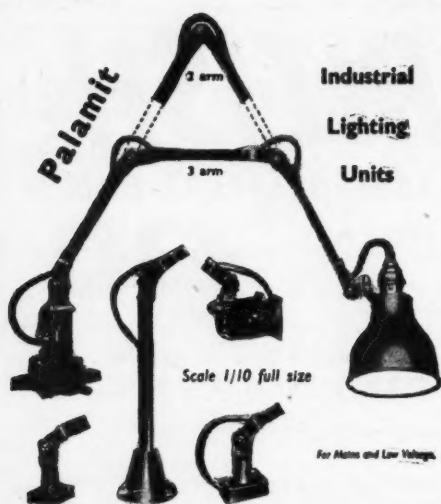
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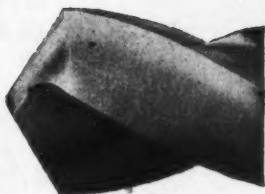
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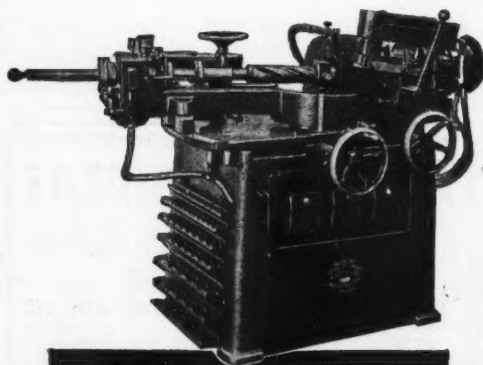
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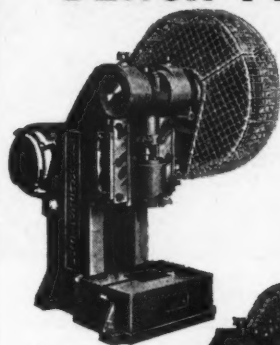
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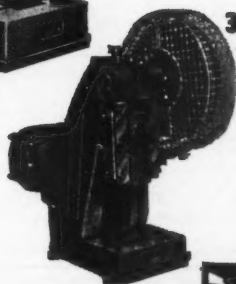
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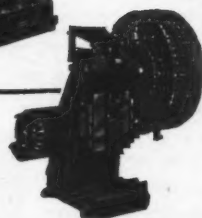
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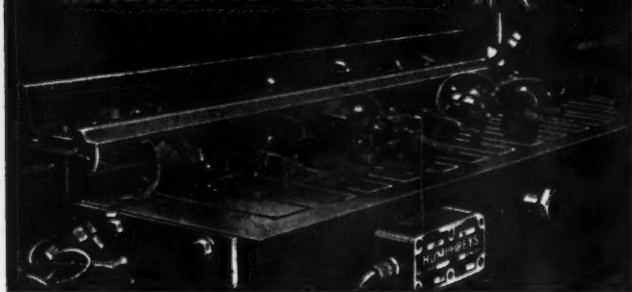
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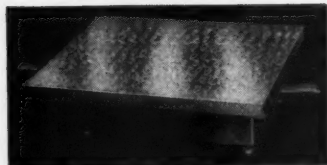


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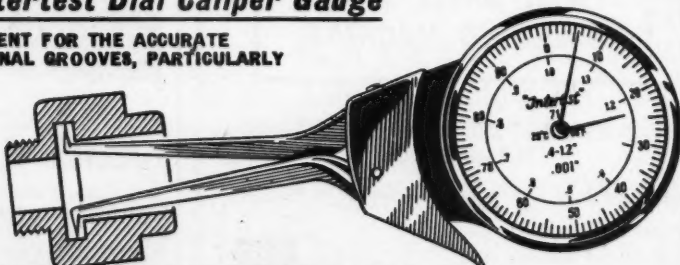
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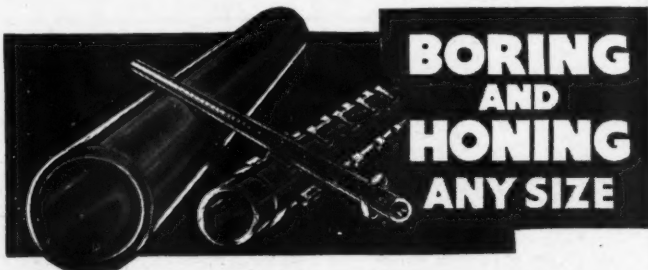
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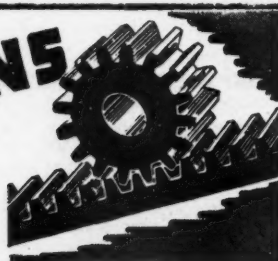
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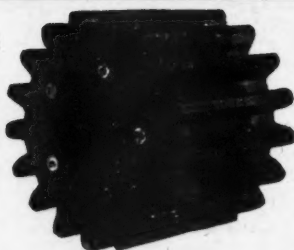
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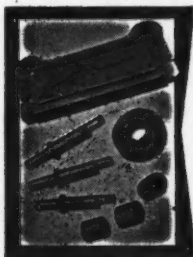
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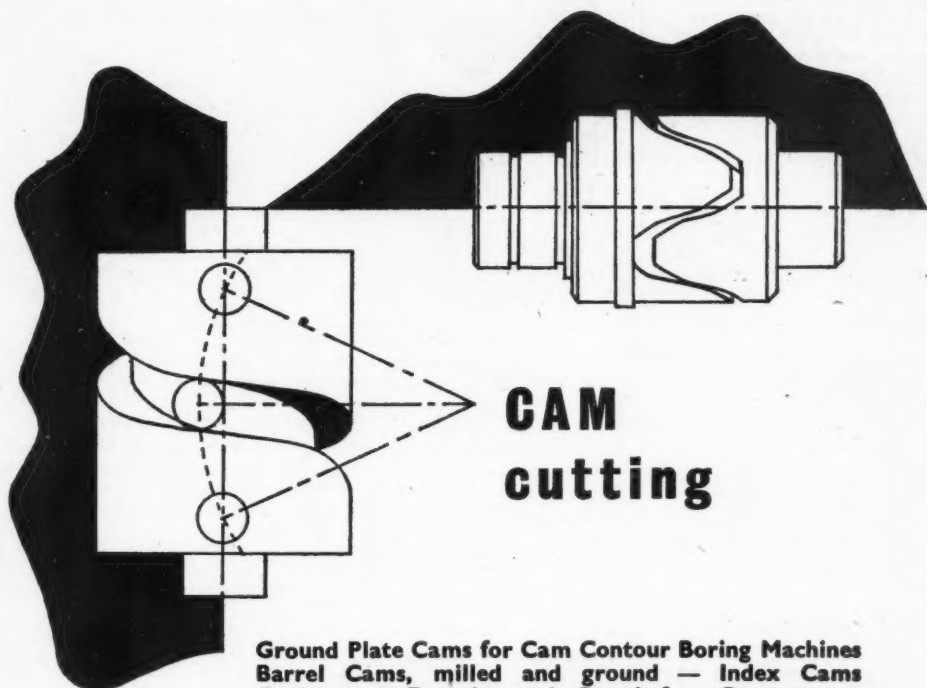
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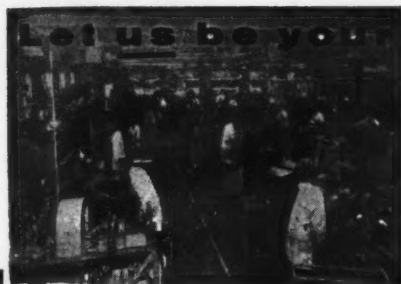
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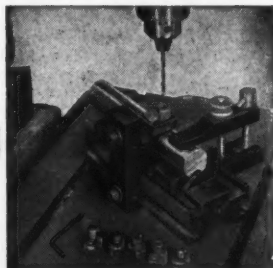
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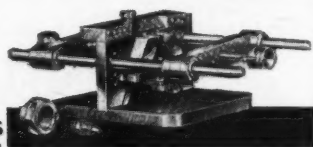


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August 16, 1961

MACHINERY

(Suppl.) 141

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Coarse feeds 1/4 in. to 2 1/2 in.

Fine feeds 0.050 in. to 2.2 in.

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EDGWICK No. 2 Dial Type Plain Horizontal Milling Machine, 46 in. x 11 in. table.
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EDGWICK 18 in. Horizontal Plain Production Milling Machine, with 40 in. x 12 in. table.

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Holroyd AN6 Thread Mill.
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D.S.G. 132 Minor S.S. & S.C.
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HERBERT 4B D/L chuck and bar feed.
HERBERT 28 air-operated chucker.
TAYLOR No. 1263 Capstan, 1/2 in. cap.

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HERBERT Type "V" Junior Geared Pillar.
HERBERT Type "V" Pillar.
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POSDICK 4 BM, 8 spin. 1/8 in.
CORONA 3M Pillar, 1 1/2 in. cap.
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CORONA Model 9FX Super High Speed Bench.

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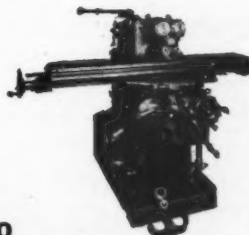
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BESCO 20 ton.
WARD 20 ton.
TAYLOR & CHALLEN 10 ton.
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THERMIG Muffle Furnace.
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BARBER & COLMAN 18in. Hobber.
THEIL Filing and Sawing Machine. £95.
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THEIL Punch Shaper.
ORMEROD 12in. Shaper with Cam Cutting
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New Stanley 84in. Centre Lathe,

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SLOUGH BUCKS

PRICED STOCK LIST OF USED MACHINE TOOLS

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Grinder. £975
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Grinder with internal Spindle.
£975.

COVENTRY Matrix 21 Thread
Grinder. £450.

CHURCHILL 20in. by 84 Plain
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crankshaft grinding. £2,850.

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Grinder. £235.

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Semi-Universal Grinder. £245.

CHURCHILL Universal Grinder
M.D. 10in. by 24in. with internal
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£830.

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CINCINNATI No. 3 Sliding Head Vertical Dial Selection, 63in. x 15in. table. £750
CINCINNATI No. 3 Sliding Head Vertical, 55in. x 13 1/2in. table. £350
DENBIGH C4 Universal Mill, 46in. x 10in. table, 2/1 vertical head. £395
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PARKSON 2P Horizontal, 52in. x 12in. table. £350

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Fly Press No. 3 **NORTON**. £27
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CENTAUR TOOL WORKS, EYRE STREET, SPRING HILL, BIRMINGHAM, 18

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Ward 1in. Capacity Bar Capstan
 Lathes with Sadi Drives, electric coolant supply.—H. BYWATER, New Spring Street, Birmingham, 18. Cen. 5795.

1 1/2in. Capacity Capstan. Power
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BULLARD Multi-Au-Matic 7in. 8 spindle.
BULLARD Multi-Au-Matic 12in. 6 spindle

BORING MACHINES

KEARNS Model OB Horizontal Boring and Facing Machine, 2 1/2in. diameter travelling spindle (1957).
UNION Model BFT100 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle (1955).
KEARNS Model OC Horizontal Boring Machine, 3in. dia. travelling spindle.
KEARNS No. 4 Horizontal Boring and Facing Machine, 4in. diameter travelling spindle.
WEBSTER & BENNETT Vertical Boring Machine, table 50in. diameter.
RICHARDS Type PRT Horizontal Floor Boring Machine, 3 1/2in. travelling spindle, 28in. diameter facing head.

CAPSTAN AND CENTRE LATHES

CHURCHILL-REDMAN Model 13NM Heavy-Duty S.S. & S.C. Gap Bed Centre Lathe, 18in. centre height x 72in. between centres. Swing in gap 50in.
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NILES Heavy Duty Centre Lathe, S.S. & S.C., 17in. centre height x 28ft. between centres.
U.L.R.O. Heavy Duty Centre Lathe, 16in. centre height x 30ft. between centres.

DRILLING MACHINES

HETTNER Radial Drilling Machine, 10ft. elevating arm.

GEAR MACHINES

ORCUTT Model HM24 Hydraulic Internal Gear Grinder.
GLEASON 3in. Straight Bevel Gear Generator.

GRINDING MACHINES

CRAVEN Roll Grinding Machine, capacity 20in. swing x 138in. between centres.
CHURCHILL Model HBY Internal Grinding Machine.
CHURCHILL Plain Cylindrical Grinding Machine, 26in. swing x 84in. between centres (1951).
LADIE Type C Plain Hydraulic Cylindrical Grinding Machine, 6in. swing x 18in. between centres.
ORCUTT Model HM24 Internal Spur Gear Grinding Machine.
CHURCHILL Plain Hydraulic Cylindrical Grinding Machine, 20in. swing x 72in. between centres.
BROWN & SHARPE Plain Cylindrical Grinding Machine, 10in. swing x 36in. between centres.

MILLING MACHINES

CINCINNATI Model 5/72 Plain Hydromatic Milling Machine, table 91in. x 22in. (1952).
CINCINNATI No. 2L Plain Horizontal Milling Machine, table 52in. x 10in.
CINCINNATI No. 1M Vertical Milling Machine.
CINCINNATI No. 4 Dial Type Horizontal Milling Machine.
FRATT & WHITNEY Model BL3620 3-spindle "Keller" Die Sinking Machine.
CENTEC Model 3R Automatic Production Milling Machine, table 25in. x 16in.

MISCELLANEOUS

LANGE & GALEN 28in. stroke Double Headed Hydraulic Shaping Machine
TAYLOR & CHALLENGER Double Sided 50-ton Geared Power Press, 10in. stroke.
NEWMAN INDUSTRIES LIMITED
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ROBOT Surface Grinder, 6in. by 18in.
FXCEL No. 1 Surface Grinder.
FRITZ WERNER 270A Cylindrical Grinder.
LANDIS H4 Cylindrical Grinder.
BROWN & SHARPE No. 5 Cylindrical
Grinder.
BROWN & SHARPE No. 13 Universal
Grinder.
CHURCHILL H.B.A. Automatic Internal
Grinder.
BRYANT No. 5 Internal Grinder.

MILLERS

CINCINNATI 1-18 Production Miller.
FRITZ WERNER 10in. by 34in. Horizontal
Mill.
EDGWICK Horizontal Mill, 11in. by 46in.,
24-405 r.p.m.
BROWN & SHARPE No. 2 Horizontal
Mill.
CINCINNATI Manufacturing Miller, 18in.
MAMMUT Horizontal Lever Mill, 10in. by
24in.
KEDALL & GENT Vert. Mill., 19in. by 69in.
IDENT Vertical Mill, 8in. by 30in.,
75-750 r.p.m.
WANDERER Univ. Mill, 12in. by 48in.,
38-480 r.p.m.

LATHES, CAPSTANS

WARD 10 Comb. Turret Lathe, 12-375 r.p.m.
WARD 8 Comb. Turret Lathe, Covered Bed,
10-800 r.p.m.
WARD 3A Ball Chuck Bar Feed.
WARD 3A Chucking Machine.
HERBERT No. 20 Turret Lathe 7in.
HERBERT No. 4 Capstan up to 750 r.p.m.
HERBERT No. 4 Capstan up to 511 r.p.m.
WARNER & SWASEY No. 2 Capstan.
SMID SRE 24 Capstan.
LANG C/Lathe 10in. by 60in. 10-500 r.p.m.
LANG 8in. by 9ft. Lathe, 9-450 r.p.m.
LANG 8in. by 24in. Lathe, 19-900 r.p.m.
D.S.G. 8in. by 36in. Lathe, 11-190 r.p.m.
HOLBROOK 8in. by 36in. Lathe, 11-400
r.p.m.
HOLBROOK 6jin. by 36in. Lathe, 15-400
r.p.m. Gap Bed.
COLCHESTER MASTER 6jin. by 36in.
Ainest Screwing Attachment.
HOLBROOK 6jin. by 36in. Lathe, 30-402 r.p.m.
ROLLO 6in. Centre Lathe.
SWIFT Profile Copy Lathe, 18in. by 5ft. 6in.

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HOBBER, SAWS**

PLESSEY Jig Borer, 12in. by 12in.
MATHEY Jig Borer.
BUTLER 14in. Slotter.
INVICTA 5M Shaper.
HOLROYD Shaper 14in. Stroke.
ESSEX No. 32 Punch Shaper.
DOWDING V.8 Gear Hobber.
KOLLE Vertical Bandsaw. 20in.

DRILLERS

POLLARD 4 Spindle Pedestal Drill.
POLLARD 3 Spindle Pedestal Drill.
POLLARD Pillar Drill, 3 M.T.
POLLARD 13 AX Pillar Drill.
POLLARD 2 AX Pillar Drill.
PROGRESS 4 E Pillar Drill.
TAUCO 4 in. Bench Drill.
 4 Spindle Bench Drill, 15 HEF.
ROLEY Multi-spindle Drill, VB 10.

MISCELLANEOUS

SCHIESS DEFRIES Vertical Keyseater.
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Hand Operated. Motorised 400-440/3/50.

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CENTEC 2 B Uni Mill.
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RICHARDS 36in. Vertical Boring Mill,
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JONES 6in. Spindle Horizontal Borer.
Table 17ft. 6in. × 8ft. Spindle travel
48in. Rapid traverse 84in. per min.
Motorised 400/5/50. Weight 70 tons.
BULLARD 36in. Vertical Boring Mill.
KITCHEN & WADE Vertical Fine Boring
Machine, 14in. stroke. Compound table.

DRILLING MACHINE

ABCHDALE 8-Spindle Hydraulic Vertical
Drilling Machine.

GRINDING MACHINES

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KELLER No. R6 Tool and Cutter Grinder.
LUMSDEN D.E. Tool Grinder.
HEAD No. 172 Gap Bed Internal Grinding
Machine, maximum diameter of com-
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between centres.
SMALLPIECE Lathe, type 6 WSLMS.
NOBLE & LUND Heavy Duty Centre Lathe.
22in. centre height × 29ft. between
centres Max. swing over saddle 33in. dia.
HARVEY Heavy Duty Centre Lathe.
42in. centre height × 52ft. between
centres Max. swing over saddle 65in. dia.

MILLING MACHINES

EDGWICK No. 2 Universal Milling Machine
Working surface of table 38in. × 71in.
BROWN & SHARPE No. 3A Universal
Milling Machine with Vertical Head Attach-
ment. Spindle Speeds 30/1,200. Power
feed all movements.
COLLET & ENGLEHARDT Keller Type.
Die Sinking Machine Model FK180,
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Machine, 12in. diameter capacity

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Drop Hammer. Weight of hammer 800 lb.
Length of drop 5ft. Width between uprights
14in. Arranged motor drive 380-420/3/50.
With Vdal Automatic operator's safety guard.

BENNIE Motorised 4-Roll Plate Bending and
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Diameter of roller 7 1/2in. Top roller bearing
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Universal Folding Machine. Capacity 10ft.
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All steel construction. Motorised for 400-
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Equipped with two back gauge stops with
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down adjustment up, 12in. Weight approx.
11 tons.

UNUSED DE BERGUE No. 34A Automatic
Geared Multiple Punching Machine. Capacity
7ft. 3in. wide × 31ft. long. Will punch
18 holes 4 1/2in diameter in 1/2in. plate, or 16
holes 1 1/2in. diameter in 1/2in. plate at one
stroke. Pressure 425 tons. Weight about
42 1/2 tons.

HOLEYD Motorised Toggle Action Rivet
Punching Machine with power lift to table.
Capacity 4in. diameter rivets. Stroke of ram
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1 1/2in. 4-operation with threading spindle.
4in. and 4in. 4-operation, threading spindles,
very late models, 4in. 3-op. All in excellent
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Universal Grinder. Internal Attachment.
New condition.

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Richards No. 2 PRT Horizontal
Boring and Facing Machine complete Live
Spindle.

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MIDLAND

BENDING ROLLS

RHODES 6ft. × 14 gauge Power Bending
Rolls.

CROPPING MACHINES

Double Ended Angle Cropping Machine.
Cap. up to 6in. × 4in. angles.

DRILLING MACHINES

POLLARD 13in. Pillar Drill, No. 2 Morse
Taper. R. & F. Table 11in. × 11in.
AMERICAN 6ft. H/Duty Radial Drill,
No. 6 M.T. Older machine, in good
condition. 400/3/50. Sep. motor.

FOLDING MACHINES

EDWARDS 6ft. × 4in. High Lift Swing
Beam Universal Folder.

GRINDING MACHINES

New NORTON 10in., 12in., 14in., 16in. and
20in. D/E Tool Grinders.
ABRATIVE No. 34 24in. × 8in Vertical
Spindle Surface Grinder.

GUILLOTINES

RUSHWORTH 4ft. × 4in. O/Crank
Guillotine. Little used.

KEYSEATING MACHINES

EDGWICK Keyseater. Stroke 4 1/2in. Table
26in. × 9in.

LATHES

HERBERT No. 4 Capstan. 24in. H/Spindle.
Speeds 511.

MILLING MACHINES

EDGWICK No. 2 Horizontal Miller. Table
46in. × 11in.
MILWAUKEE 3H Vertical Milling Machine.

NIBBLERS

BURFEE 2A Nibbling Machine. Cap.
4in. M/S.
W.F. 14 Gauge Nibbler. 59in. throat.

PRESSES

TAYLOR & CHALLENGE 370, 20 Ton O/F
Press.
TAYLOR & CHALLENGE 845 Dial Feed
Notching Press. Cap. 6 tons.
TAYLOR & CHALLENGE 1455 Dial Feed
Notching Press. Cap. 2 tons.
BRADLEY & TURTON No. 3 Flypress.
SWEENEY & BLOCKSIDGE Bench Press.
Cap. 3 tons.

SAWING MACHINES

BARSON No. 1 Saw. 1 1/2in. rounds, 2in.
tubes, 1 1/2in. × 4in. flats. 1 1/2in. × 4in.
angles.

SCREWING MACHINES

KENDALL & GENT 5in. Screwing Machine.
Lead screw type.

POLISHING MACHINES

3 and 5 h.p. Double Ended Polishing
Spindles.

WELDING EQUIPMENT

PRESCOTT 15 kVA Spot Welder.

CRANES

BROADBENT 40 Ton O.E.T. Crane.
10 ton auxiliary lift.

All machines 400/3/50 electrics unless
otherwise stated

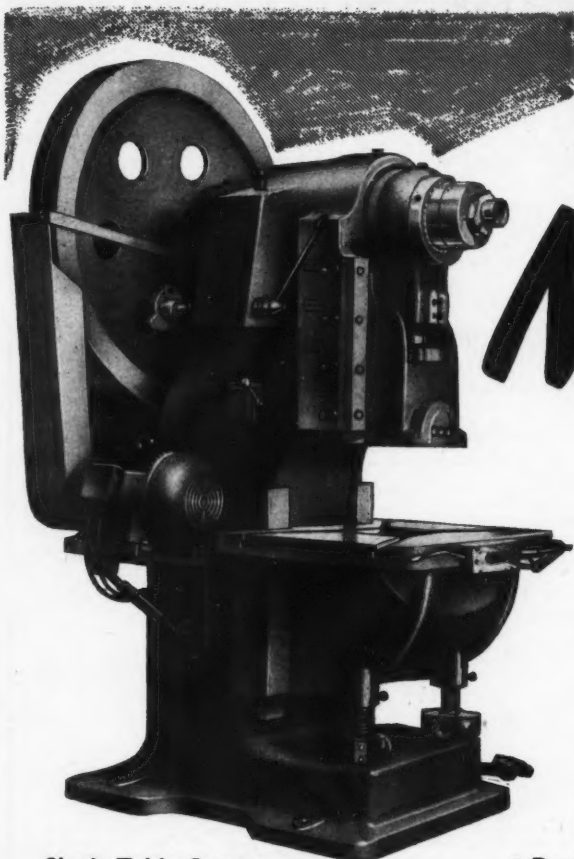
THE

MIDLAND MACHINE TOOL CO.

BRADLEY, BILSTON, STAFFS.

Tel. Bilston 42471/9

When answering advertisements kindly mention MACHINERY.



TATE

New

**MULLER
OPEN FRONTED
ADJUSTABLE TABLE,
ADJUSTABLE STROKE,
POWER PRESSES**

**MANY OTHER MODELS UP TO
2000 TONS**

Specification

Single Table Screw

Pressure ...	22-tons	30-tons	35-tons
Power required...	2 h.p.	3 h.p.	3 h.p.
Table area ...	20½" x 13½"	21½" x 16½"	21½" x 16½"
Vertical adjustment to table ...	6½"	4½"	4½"
Adjustment of stroke ...	¾"-3½"	¾"-3½"	¾"-3½"
Ram adjustment ...	2"	2"	2"
Max. distance table to ram ...	11½"	12½"	12½"
Min. distance table to ram ...	5½"	7½"	7½"
Stroke per minute ...	120	110	110
Net weight ...	23 cwts.	26 cwts.	27 cwts.

Double Table Screw

35-tons	45-tons	60-tons	80 tons	100-tons
3 h.p.	3½ h.p.	4 h.p.	5½ h.p.	7-5 h.p.
21½" x 16½"	25½" x 18½"	29½" x 20½"	32½" x 21"	35½" x 23½"
4½"	5½"	8½"	9"	9"
¾"-3½"	¾"-3½"	¾"-5½"	¾"-5½"	¾"-5½"
2"	2½"	2½"	2½"	2½"
12½"	13"	13½"	14½"	17½"
7½"	7½"	4½"	5½"	8½"
110	110	100	85	80
28 cwts.	2 tons	2½ tons	3½ tons	4½ tons

ALL THE ABOVE MACHINES FOR IMMEDIATE DELIVERY FROM OUR LONDON SHOWROOMS

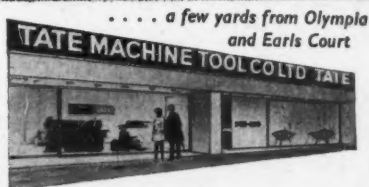
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TELEPHONE: WESTERN 7051 (5 LINES)

CABLE ADDRESS: TATETOOLS, LONDON





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ALL MACHINES MOTORISED FOR 3 PHASE SUPPLY UNLESS OTHERWISE STATED

**AUTOS**WICKMAN 10 mm.
GREENLEE 1 in. x 6 spindle.**BORERS (Horizontal)**

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BROACHING

AMERICAN model H2, stroke 30 in.

CAPSTANS

PITTLER type RGII 82.

MURAD 3 in.

HERBERT 48 and 4.

CUTTING OFF MACHINES

TAYLOR 10 in.

DRILLS

NATCO 24 spindle No. 1 M.T.

CORONA Type 15CX 2 spindle.

HERBERT 2 spindle.

MONMOUTH 4 spindle No. 2 M.T.

ARCHDALE 3 ft. Radial No. 3 M.T.

DENBIGH 24 in. B.G.

HERBERT "C" Power Feed.

CORONA No. 21 AR, No. 3 M.T.

JONES & SHIPMAN 8 1/2 in. cap.

CORONA IAX, No. 1 Morse Taper.

LELAND GIFFORD 2-sp., No. 2 M.T.

HERBERT Type B, Single Spindle, 3 in.

CORONA 6MX Cluster Type.

HERBERT Type H, 3 in. cap.

ENGRAVERS

T.T. & H. 3 dimensional.

ALEXANDER No. 2, 3-dimensional.

LIENHARD 3-dimensional. (New.)

LIENHARD No. 1H.

HUFFIELD Router.

T.T. & H. Type C, C.B. and M.A.

T.T. & H. Multi Etcher.

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WICKSTEAD No. 1 Hacksaw.

RAPIDOR 6 in. Hacksaw.

RAPIDOR Filing.

FOLDERS

Sheet Edging, 30 in. x 22g.

GEAR CUTTERS

SAFAG Pinion.

MAXICUT 7 in. x 2 in. x 6 D.P.

PETERMAN No. 1 and 2.

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CHURCHILL HBY.

BRYANT 16/38 and 5.

GRINDERS (Surface)

CHURCHILL OSB 8 in. x 30 in.

LUMSDEN Vert. 210 XXM.

ABRASIVE No. 34 Vertical Spindle.

GRINDERS (Cylindrical)

CHURCHILL 6 x 36 in. B.Y.

CHURCHILL PBH 12 x 36 in. Univ.

NEWALL 6 x 18. Model XL.

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JONES & SHIPMAN, 10 in. x 27 in. T. & C.

J. & S. Drill, 3 in. to 3 in.

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HUNT No. 0, 2 and 3 Drill.

CHURCHILL Valve.

HONER

DELAPENA 4-speed.

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ASQUITH H.K.O. Horiz. Duplex.

EDGWICK 4 in.

LATHES

DEAN SMITH & GRACE 7 in. S.S. & S.C.

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SOUTHBEND 10 in. Toolroom.

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SMALLPIECE 95W Multi-tool.

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WARD, HAGGAS & SMITH 8 in. x 78 in.

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CANNING 54 in. x 2 HP Polisher.

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ST. ANDREA Model UFO3 Table 57 x 14.

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HARDING Precision. Table 25 x 6 1/2.

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JONES 225 Univ. Table 22 x 6.

ARCHDALE 20 in. dial and 14 in. mfg.

RICHMOND O3. Table 40 x 10.

U.S. Multi Mill.... Production.

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BROWN & SHARPE No. 2 Light.

C.V.A. 79 Tool and Die.

REED PRENTICE No. 5, 68 in. x 16 in. table.

WADKIN Type LXIA. Table 36 in. x 13 in.

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BLISS No. 16 Bar.

LECRAN No. 8. 4 tons.

WRIGHT Clicking Press.

PROFILING MACHINE

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RIVETERS

HIGH SPEED Hammer, 7/16 cap.

TURNER RH18 (3 in.), RH38 (3 in.), RH34

(3 in.), RH14 and 14/12 (3 in.).

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ATLAS No. 2, 3 in.-6 in. (Unused.)

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NEWLEY 14 in.

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BESCO 48 in. Power Guillotine.

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WICKMAN MOULTON 18.

SELECTED MACHINES**BECHLER CER 50** Single Spindle Automatic, Ser. 600516. 2 in. bar cap, speeds up to 1,500 r.p.m. Complete range of tooling, collets and feed fingers. Vast quantity of new spares.**C.V.A. S.S. Automatic Ser. 31488**, 3 in. cap., range of tooling, collets, etc., bar feed.**WANDERER Vertical Mill, Type 1FV**, Ser. 5463. 1954. Swivel head, No. 50 I.T. 16 speeds—45 to 1,400 r.p.m. Table 30 in. x 12 in. Power feeds and rapid traverse all directions. Coolant. Late type machine.**PEGARD Auto Production Mill**, speeds 22 to 1,128 r.p.m. Table w/8 30 in. x 12 in. Auto feed cycle. Kneeless with R and F head, retractable spindle, coolant. Late type machine.**RHODES No. 2 Double Side Inclinable** Dieing Press, 45 tons, variable strokes per min. 10 to 450. Adjustable stroke 4 in. to 2 1/2 in., roll feed and scrap shear. All machines motorised 415/3/50.**A. LAWRENCE & CO.,
(MACHINE TOOLS) LTD.,**WELSH HARP, EDGWARE ROAD,
LONDON, N.W.2.
Tel. GLA. 0093.**Broadbent 10 ft. 0 in. Vertical**

Boring and Turning Mill. Raised Column to give 88 in. under Toolholder. New 1959 and in new condition.

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good condition with some equipment, £325. Corona 3 Spindle Drilling Machine, Motorised, £250.

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Telephone: Fulham 1051.

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MACHINE TOOLS**Used **PRECIMAX** Type UPJ12/72 Hydraulic Universal Cylindrical Grinding Machine with variable speed workhead and electric to suit 400/3/50.Used **CINCINNATI** No. 2 Tool and Cutter Grinding Machine. 400/3/50.**HERBERT** No. 12 Heavy Duty Combination Turret Lathe. Full chucking equipment. 400/3/50.**TOWN** 28 in. Vertical Spindle Drilling Machine. Compound table. 400/3/50.**K. & W.** 33 in. Sensitive Radial Drilling Machine. Swing-aside table, swing-aside arm. 400/3/50.**JONES & SHIPMAN** 20 in. Vertical Drilling Machine. No. 4 Morse Taper. Power feed. 400/3/50.**KEARNS** No. 2 Standard Horizontal Boring Machine with facing head and sliding spindle. 400/3/50.**SNOW** 120 Table Surface Grinding Machine.**ARCHDALE** 28 in. Horizontal Manufacturing Milling Machine, with power and rapid feeds. Table size 49 in. x 30 in. 400/3/50.**WE UNDERTAKE REBUILDING OF ALL TYPES OF MACHINE TOOLS****CENTAUR TOOL WORKS,
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Classified Advertisements (PLANT FOR SALE, contd.)

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LEEDS 63-7398

NEW MACHINE TOOLS

FOR QUICK DELIVERY

COLCHESTER LATHES

Kamenicek Universal Grinding Machines.

Kamenicek Internal Grinder.

Richmond Plain, Universal and Vertical Millers.

Zbrojovka Plain, Universal and Vertical Millers.

MITCHELL LATHES

Kamenicek Tool and Cutter Grinders.

Richmond Model S.R.2 and H.B.3 Radial Drilling Machines.

Vernier Millers.

Plauert Horizontal Boring Machines.

Please telephone or write for full details—

The Selson Machine Tool Co. Ltd.,
Sunbeam Road, London, N.W.10.

Telephone: Elgar 4000

ROYAL BURGH OF IRVINE INDUSTRIAL ESTATE DISPOSAL OF HEATING INSTALLATION

The Town Council invite offers for all or any of the undernoted items comprising the Heating Installation at the Irvine Industrial Estate, which was formerly a Royal Ordnance Factory operated by the Ministry of Supply. The Installation, which is in good condition, was erected in 1938 and comprises:—

4 "Cochrane Kirke" Sinuflo Economic Boilers, each of 18,000 lb. steam per hour at 100 lbs. per square inch, with Bennis induced draught coking stokers; 1 Zeolite water softening plant and chemical dosing gear. 2 Feed Tanks. 2 Feed Pumps. 1 Instrument Panel (Main). 1 Coal Elevator and Conveyor. 1 Ash Elevator. 4 Overhead Coal Bunkers. 4 Steel Chimneys 3ft. 6in. diam. by 53ft. high. 4 Boiler Instrument Panels. 2 Feed Water Meters. 1 Emergency Battery Lighting Set.

One of the Boilers is in use and Insurance Reports are available for inspection. The plant may be inspected by arrangement with the Burgh Surveyor, Heathfield, Kilwinning Road, Irvine (Telephone: Irvine 2051), who will also provide full particulars of the plant. Offers marked "Heating Plant" should be lodged with the undersigned, not later than 2nd October, 1961. The highest or any offer may not be accepted.

ROBERT WHYTE,
Town Clerk.

Council Chambers,
IRVINE, 3rd August, 1961.

Small advertisements telephoned
Wednesday, will be inserted the
following Wednesday.

Warner & Swasey No. 1A Combination Turret Lathe, Serial No. 434730.

Further details from —
C. & G. OLDFIELD, LTD.,
15, Abercorn Street,
PAISLEY.
Member of B.A.M.T.M.

Kearns No. 1 Horizontal Boring and Facing Machine, complete with Rear Star. A.C. Motor.

Further details from:—

C. & G. OLDFIELD, LTD.
15, Abercorn Street,
PAISLEY.

No. 9A Herbert M/D All-gd.

Combination Turret Lathe. Covered vee bed. Swings 20 $\frac{1}{2}$ in. dia. over bed. Roller bearing spindle bored 4 $\frac{1}{2}$ in. dia. Admits 60in. spindle to turret. 16 spindle speeds 21-800 r.p.m.—LEE & HUNT, LTD., Crocus Street, Nottingham. Phone 54240.

Kitchen & Wade H5 Horizontal Boring and Drilling Machine, complete with Square Box Table and Auxiliary Revolving Table. Machine equal to new.

Further details from —

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15, Abercorn Street,
PAISLEY

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Maintenance Engineer Required

by progressive smaller spring manufacturer to take complete control of machine-shop. Excellent salary and scope for the right man. State age, experience and salary. All applications will be treated in confidence.—BOX D155, MACHINERY, Clifton House, Euston Road, N.W.1.

LONDON TUBE MILL Require a man well experienced in the running of a Mild Steel tube mill. Extremely good prospects for promotion but he must at first be in the position to work shifts.

Apply H.U.B. Ltd.,
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When answering advertisements kindly mention MACHINERY.

AUCTIONS



By order of the SECRETARY OF STATE FOR WAR, Messrs.

FULLER HORSBY Sons & Cassell

have been instructed to offer for SALE by AUCTION in Lots at the ROYAL ARSENAL, WOOLWICH, LONDON, S.E.18, on TUESDAY, 29th AUGUST, 1961, and the following days at 10.30 a.m. precisely each day

ENGINEERS' MACHINE TOOLS INDUSTRIAL EQUIPMENT AND SURPLUS STORES

Including Cincinnati 3/24 PLAIN HYDROMATIC MILLING MACHINE; Kitchen & Wade motorised VERTICAL CYLINDRICAL HONING MACHINE; Thompson HYDRAULIC BROACH GRINDER; SURFACE, CYLINDRICAL, ROTARY and other GRINDERS; S.S. & S.C. LATHES; PLAIN, UNIVERSAL and VERTICAL MILLING MACHINES; VERTICAL DRILLING MACHINE; POWER PRESSES; 210 Petrol Electric CHARGING SETS; 39 Russell-Newbury 62.5 kVA DIESEL ELECTRIC GENERATING SETS; Petrol Electric Generating Sets; 8 Coventry Climax FORK LIFT TRUCKS; M.T. Spares; "Matbro-Mantis" Diesel Driven HEAVY DUTY HYDRAULIC EXCAVATOR; Aveling Barford Petrol ROAD ROLLER; CONCRETE MIXERS; 8 Barber, Greene TAR MACADAM PLANT DRYERS; 4,000 pairs BINOCULARS; 1,700 POCKET WATCHES; 500 WRISTLET and STOP WATCHES; 2,000 PRISMATIC COMPASSES; 400 SIGNALLING TELESCOPES; ELECTRIC CABLE; Electrical Stores; Scrap Radar and Wireless Equipment, RECEPTION SETS; COMMUNICATION RECEIVERS, 160 cases WIRELESS KIT EQUIPMENT; Portable Batteries; THEODOLITES, SURVEYORS' LEVELS; 3,000 Ammeters, Voltmeters and Wavemeters; Tool Kits; Small Tools, Service Clothing; Furniture and numerous other effects

Catalogues 1/- each admitting two persons on view days (Wednesday, Thursday, Friday and Monday preceding Sale) and one on Sale Days, may be had, when ready, from the AUCTIONEER'S OFFICES, Dept. 10, 10, Lloyds Avenue, London, E.C.8.

Top Grade Sales Engineer

REQUIRED BY COMPANY EXPANDING THEIR RANGE OF HIGH GRADE SPECIALISED MACHINE TOOLS

A thorough engineering background, initiative and ability to deal expeditiously with correspondence are essential. Preference will be given to candidate with a knowledge of German and previous sales experience.

This is an interesting position for a young and energetic man, with good prospects leading to Technical Sales Manager.

Please write fully in strictest confidence to—

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The Mulhead Engineering Co. Ltd.

is shortly moving into a new factory, and applications are invited for the following DRAWING OFFICE vacancies—

1. SENIOR MACHINE TOOL DESIGNER
Must be a man with established record in this field, preferably with experience of Rotary Transfer Machines and Unit Heads.

2. SENIOR AND JUNIOR JIG AND TOOL DRAUGHTSMEN for design and detailing of fixtures and Multi-Spindle Drill Heads.

Housing will be available in Hatfield for selected applicants.

Apply:

CHIEF DRAUGHTSMAN,
THE MULHEAD ENGINEERING
CO. LTD.,
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R.R.E. COLLEGE OF ELECTRONICS MINISTRY OF AVIATION ROYAL RADAR ESTABLISHMENT MALVERN

Grade B Assistant Lecturer
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Applicants should be suitably qualified with at least a Higher National Certificate in Production or Mechanical Engineering, and have teaching and/or industrial experience.

Burnham Salary Scale, grade V, £700 × £27 10s.—£1,150, with appropriate allowances, up to £285, for suitable training and qualifications; subject to the Teachers' Superannuation Acts.

Further details and application forms from the Principal for return within two weeks of the appearance of this advertisement.

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MAAG GEAR GRINDERS

MODEL HSS. 10 and
HSS. 30

Urgently required

Frye Machine Tool Co.
LTD.,
POYLE ROAD, COLNBROOK,
SLOUGH, BUCKS.

Wanted, 8-10in. Centre Lathe, horizontal milling machine, surface grinder by a toolmaker wishing to start up his own shop. Reasonable offers please.—H. CLARIDGE, 14, Francis Road, Harrow Middlesex.

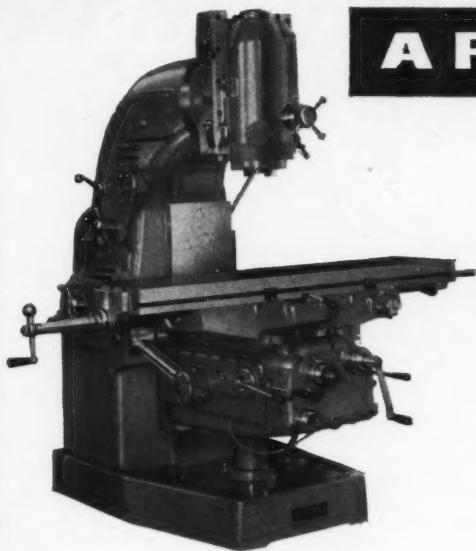
CONTRACT WORK

Immediate Capacity Available—8ft. diam. Vertical Borer.
R. H. NEAL & CO., LTD.,
Grantham.

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Team of Mechanical and Struc-tural Draughtsmen require Designing, Drawing, Tracing work.—BOX D168, MACHINERY, Clifton House, Euston Road, N.W.1.

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ADVERTISEMENT
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PAGE 127. SERIES
RATES ON REQUEST.



ARNO

VERTICAL MILLERS

Model	Model
3L	3H
Table 59" x 12"	70" x 15"
Speeds 30 - 1200 rpm	22 - 1200 rpm
Traverses 43" x 13" x 18"	53" x 14" x 21½"
Horsepower 9	15
Weight 4840 lbs.	7040 lbs.

SOLE AGENTS:

PIDGEN BROS LIMITED

HELMET ROW, OLD STREET,
LONDON, E.C.1.

Telephone: CLerkenwell 6481

... with backlash eliminator,
spindle stop, rapid traverses,
swivel and sliding head.

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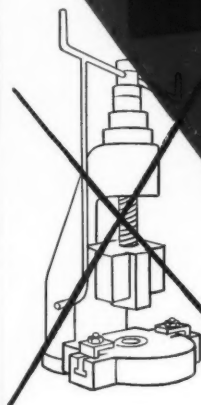
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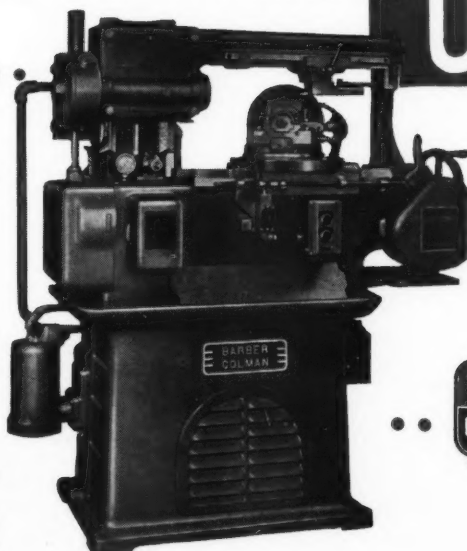
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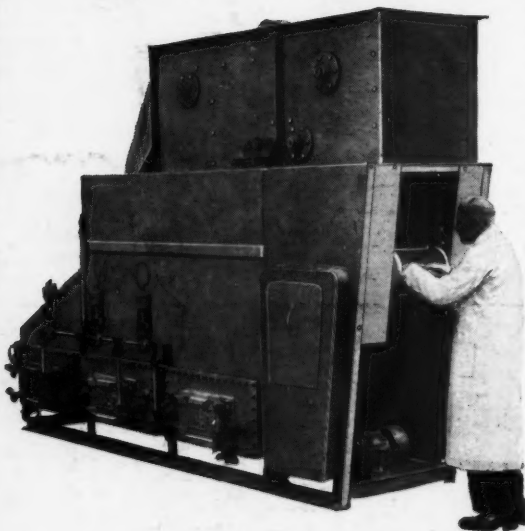
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LONDON: HARRISON & SONS, LTD., by Appointment to Her Majesty The Queen, Printers, London, Hayes (Middx.) and High Wycombe.

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